Let's make Artificial Intelligence (AI) a powerful tool of education, that will enable us to become master of ourselves, our country and our nation.

ARTIFICIAL INTELLIGENCE IN KOSOVA EDUCATION

PERSONAL OPINION

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"I dedicate this work to my wife Kimete, an exemplary teacher, whose love, advice and unwavering support have been my constant inspiration."

PREFACE

The history teaches us that victorious armies have never been those with the highest numbers, no matter how many ordinary soldiers follow orders, but rather the armies that have had the optimal number of skilled, intelligent, and well-trained cavalrymen, equipped with excellent weapons, masters of the art of war, especially equipped with a strong sense of motivation and patriotism. Let us just remember the magnificent victories of Alexander the Great and Skanderbeg against the much larger armies of the Persian respectively the Ottoman empires, which had the reputation of global superpowers of their time.

If we put this in parallel with education, then we can say that successful nations can never be those who produce students who only know how to listen and repeat what the teacher tells them, but those who cultivate skillful, intelligent, curious students, open-minded and motivated with feelings of patriotism. Since the "commanders" of education are the teachers, then it is clear how they have to work with their students.

Despite significant challenges throughout history, our educators have always made a decisive contribution to preserving our national identity, language, and culture. There is no doubt that this will continue to be the case in the future. In fact, I believe that the challenge of implementing artificial intelligence technology in our schools will be seen as an opportunity to address some evident shortcomings in our educational system, paving the way towards a much higher-quality education, comparable to that of more developed countries.

The transition to the era of Artificial Intelligence (AI) has already begun in our country, sometimes spontaneously and often without us being fully aware of it. It is now used in the form of simple applications by people of all ages, from toddlers to university professors. Young people, in particular, are avidly using tools such as ChatGPT[1], Bing, Bard, Dall-E, and others.

This work aims to elaborate the intersection of Artificial Intelligence and Education, with a focus on the implementation of AI in Kosova's education. It delves into various aspects of AI in Education (AIED), including its basics, the transformative potential of AI in rethinking education, and the application of AI for personalized learning, student engagement, data-driven decision making, and intelligent content creation. Additionally, the document discusses the importance of personalized feedback, assessment, accessibility, and inclusion in education. Lifelong learning and skills development, predictive analytics, and early intervention are also examined as crucial components of AIED.

Furthermore, this work emphasizes the need for human-centered AIED, emotional intelligence, and the cultivation of a growth mindset in educational contexts. It discusses inner values and social entrepreneurship as integral to the ethical and responsible use of AI in education. The relationship between Outcome-Based Education (OBE) and the job market is explored, highlighting the role of universities and providing insights from the Arizona State University (ASU) example. The work aims to examine how AI can facilitate the transition towards OBE.

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[1] ChatGPT is a conversational artificial intelligence model developed by OpenAI. It's part of the GPT (Generative Pre-trained Transformer) family of models and is specifically designed for generating human-like text in a conversational manner. ChatGPT is trained on a wide range of internet text and is capable of understanding and generating human-like responses in natural language, making it suitable for chatbots, virtual assistants, and other applications that require interactive and natural-sounding conversations with users.

Amidst these discussions, the work addresses dilemmas surrounding AIED, including opportunities, challenges, and risks. It outlines a strategic framework for the implementation of AIED in Kosova, considering the local context, Albanian national and cultural context, digitalization, and the tech industry. The document also analyzes Kosova's education landscape, drawing from PISA 2018 results to identify strengths and weaknesses of our students in light of utilization of AIED.

In the end, a reflection on the activities, recommendations, and policies carried out by global organizations in this field is provided, along with the most prominent examples of AIED implementation worldwide.

This work may help educators, policymakers, and stakeholders interested in harnessing AI's potential to enhance education.

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1 INTRODUCTION

1.1 ARTIFICIAL INTELLIGENCE (AI) CORE CONCEPTS

The three core elements of artificial intelligence (AI) are:

- **Data:** Data is the foundation of AI. AI systems require vast amounts of data to learn and make predictions or decisions. This data can be structured (e.g., databases) or unstructured (e.g., text, images, audio). Quality and quantity of data are critical factors in AI performance.
- **Algorithms:** Algorithms are the mathematical and computational procedures that AI systems use to analyze data, make sense of patterns, and make predictions or decisions. Different AI algorithms are designed for various tasks, such as machine learning algorithms for pattern recognition or deep learning algorithms for neural network-based modeling.
- **Computation:** Computation refers to the hardware and processing power needed to perform AI tasks efficiently. Modern AI often relies on powerful computers, including GPUs (Graphics Processing Units) and TPUs (Tensor Processing Units), to process large datasets and execute complex algorithms quickly.

These three core elements work together to enable AI systems to learn from data, extract meaningful insights, and perform tasks that traditionally required human intelligence, such as natural language understanding, image recognition, and decision-making. AI development involves the interplay of data collection and preparation, algorithm design and training, and robust computational infrastructure.

In the realm of artificial intelligence, the following concepts or scientific disciplines have crucial roles on the utilization of data and algorithms to emulate the human learning process, progressively enhancing its accuracy:

- **Machine learning** is a branch of AI and computer science which focuses on the use of data and algorithms to imitate the way that humans learn, gradually improving its accuracy. It is an umbrella term for solving problems for which development of algorithms by human programmers would be cost-prohibitive, and instead the problems are solved by helping machines ‘discover‘ their ‘own‘ algorithms.
- **Neural networks**, also known as Artificial Neural Networks (ANNs) or Simulated Neural Networks (SNNs), are a subset of machine learning and are at the heart of deep learning algorithms. Their name and structure are inspired by the human brain, mimicking the way that biological neurons signal to one another. Artificial neural networks are used for solving AI problems; they model connections of biological neurons as weights between nodes. A positive weight reflects an excitatory connection, while negative values mean inhibitory connections. All inputs are modified by a weight and summed. This activity is referred to as a linear combination. Finally, an activation function controls the amplitude of the output. These artificial networks may be used for predictive modeling, adaptive control and applications where they can be trained via a dataset.
- **Deep learning** is a subset of machine learning, which is essentially a neural network with three or more layers. These neural networks attempt to simulate the behavior of the human brain—albeit far from matching its ability yet. Deep learning drives many AI applications and services that

> improve automation, performing analytical and physical tasks without human intervention. Deep learning technology has the potential to transform the education system and make it more equitable. It can accelerate the long-overdue transformation of education systems towards inclusive learning that will prepare young people to thrive and shape a better future.

In conclusion, artificial intelligence (AI) revolves around three fundamental elements: data, algorithms, and computation.

Data serves as the bedrock upon which AI systems learn and make decisions, with quality and quantity being crucial factors. Algorithms are the mathematical procedures that analyze data and make predictions, while computation involves the hardware and processing power needed to execute AI tasks efficiently.

Within the AI landscape, several core concepts play pivotal roles in leveraging data and algorithms to emulate human learning processes. Machine learning is a key branch, enabling machines to "discover" their own algorithms from data. Neural networks, inspired by the human brain, model connections between nodes and are the foundation of deep learning, which drives many AI applications. Deep learning, with its multi-layered neural networks, holds the potential to revolutionize various domains, including education.

1.2 APPLICATION OF AI TECHNOLOGY IN EDUCATION (AIED)

AIED is a complex and new technology, so it is difficult to find suitable books or materials to learn the basics of this technology and its extraordinary implications in the field of education. Therefore, as a basic reference, I recommend you read: "Artificial intelligence and emerging technologies (virtual, augmented and mixed reality) in schools: A research report."[2], commissioned by the Australian Department of Education and conducted by the University of Newcastle.

The report defines AI as a machine or computer program that uses human-like thinking to complete a task. This includes robots that mimic human interaction, robotic manufacturing systems, and ubiquitous computing systems. AI can also be invisibly infused into everyday computing applications we use, such as internet search engines or the facial recognition tagging technology of social media applications.

The report also discusses common misconceptions about AI. For example, it clarifies that current AI has not yet mastered developmental milestones that average human children master around age four. However, current AI can outperform humans in specific domains and on certain narrow or focused tasks.

Another misconception is that AI is synonymous with robots. While there is overlap between AI and robots, most AI tools are not embodied in robots and many robots are not powered by AI.

The report emphasizes the need for children and adults to have personal experience, guidance, and realistic information about the capability of AI and how AI works so that they do not develop misconceptions about the technology.

This paper aims to present in detail the possibilities of use and the implications of AI in the field of education (AIED), to inform and sensitize the general opinion and especially the teachers and policy makers about the need to implement this technology in the education of Kosova.

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[2] Southgate, E., Blackmore, K., Pieschl, S., Grimes, S., McGuire, J. & Smithers, K. (2018). "Artificial intelligence and emerging technologies (virtual, augmented and mixed reality) in schools: A research report.", University of Newcastle, Australia, August, 2019.

2 RETHINKING EDUCATION IN THE AGE OF AI

2.1 AI REVOLUTION

Education systems need to be rethought thoroughly in light of AI advancements. This technology is advancing at the rate of geometric progression. AI systems perfect themselves automatically, process data and improve their learning and communication performance with humans at speeds that cannot be imagined. This is the beginning of a radical transformation that human activities will undergo in all fields. "How artificial intelligence is transforming the world"[3]

AI bots already offer services to every person in the world who wants to learn something. They communicate in most of the world languages, including the Albanian. They have the knowledge of an encyclopedist, and response with unmatched accuracy and with dizzying speed, on any question asked.

Adopting the AIED systems is out of any question despite the big challenges it involves. **"Generative AI opens new horizons and challenges for education, but we urgently need to take action to ensure that new AI technologies are integrated into education on our terms"**, said Stefania Giannini, UNESCO's Assistant Director-General for Education. **"It is our duty to prioritize safety, inclusion, diversity, transparency and quality."** "UNESCO unveils new AI roadmap for classrooms"[4]

Ms. Giannini's statement underscores the transformative potential of Generative AIED while emphasizing the imperative for us to proactively guide its integration, ensuring that it aligns with our core values of safety, inclusion, diversity, transparency, and quality.

However, **there is an ongoing debate** about the use of AIED. Some people are concerned about the potential risks and challenges that come with integrating AI into the classroom, while others see it as an opportunity to enhance learning and teaching. For example, an article from Brookings Institution discusses whether schools should ban or integrate generative AI in the classroom. The article suggests that schools should develop guiding principles for the use of AI tools, provide training resources for educators, and empower educators to implement those principles. "Should schools ban or integrate generative AI in the classroom?"[5]

UNESCO has also called on **governments to quickly regulate Generative AI in schools** and has published the first-ever global Guidance on Generative AIED and Research. The guidance sets out the necessary key steps for governments to take to regulate Generative AI and establish policy frameworks for its ethical use in education and research. "Governments must quickly regulate Generative AI in schools"[6]

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[3] Darrell M. West, John R. Allen, "How artificial intelligence is transforming the world", BROOKINGS, April 24, 2018.

[4] UN News, "UNESCO unveils new AI roadmap for classrooms", 26 May 2023.

[5] Regina Ta, Darrell M. West, "Should schools ban or integrate generative AI in the classroom?", BROOKINGS, August 7, 2023.

The AI revolution started with the ChatGPT[1], a chatbot launched on 30 November, 2022 by OpenAI, a research laboratory founded by some of the biggest names in tech such as Elon Musk, Reid Hoffman, Peter Thiel, and Sam Altman. The current Chief Technology Officer (CTO) of OpenAI is Mira Murati, US based, Albanian-born engineer and business executive. She joined OpenAI in 2018 and later became its CTO, where she leads the company's work on ChatGPT, Dall-E, and Codex.

ChatGPT set a record as the fastest app to reach 100 million active users, reaching that milestone in just two months! As of March 2023, ChatGPT has more than 1.6 billion users worldwide, which is 55.84% higher than February 2023. OpenAI was most recently valued at $29 billion, in a $10 billion funding round by Microsoft.

Microsoft and Google have both been working on their own AI chatbots. Microsoft announced the integration of ChatGPT, OpenAI's viral artificial-intelligence chatbot, into its Bing search engine, while the Google responded by launching its own chatbot, Bard. And this is just a beginning, since this technology is spreading with an unprecedented speed around the world.

As we stand at the crossroads of traditional pedagogy and modern digital landscapes, it becomes imperative to delve into the profound and multifaceted impacts of AI on education. "Revolutionizing Personalized Learning: How Is AI Changing Education?"[7]

In the article "Digital Technologies and the Automation of Education — Key Questions and Concerns"[8] the authors discuss how education is becoming steadily infused with small acts of technology-based automation, which are intrinsic to the software, apps, systems, platforms and digital devices that pervade contemporary education.

The authors argue that while each individual instance of automation might appear to be of minor importance, when viewed as a whole, these instances soon mount up. Over the past 10 years or so, responsibility for all manner of everyday educational decisions and tasks has been passed over to automated software, systems and platforms. Automated decision-making (ADM) technologies now play a key part in how job candidates are pre-selected, students are deemed to be 'failing' and school resources are allocated.

The authors suggest that it is important for anyone involved in any way with a school, university or other educational setting to remain mindful of how things are regularly being done for them (and done to them) by software that they might have little awareness of. They also raise many questions about the presumptions and promises of these educational automations. The article concludes by calling for a thorough interrogation of the presumptions and promises of these educational automations.

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[6] Audrey Azoulay, UNESCO Director-General, "Governments must quickly regulate Generative AI in schools", 8 September 2023.

[7] Tiago Santana, "Revolutionizing Personalized Learning: How Is AI Changing Education?", Gray Group International, June 30, 2023.

[8] Neil Selwyn, Thomas Hillman, Annika Bergviken Rensfeldt & Carlo Perrotta , "Digital Technologies and the Automation of Education — Key Questions and Concerns", Postdigital Science and Education, Published: 29 October 2021, volume 5, pages15–24 (2023).

The other article “Artificial Intelligence in Education (AIED): a high-level academic and industry note 2021”[9] by Muhammad Ali Chaudhry and Emre Kazim provides a comprehensive overview of the current state of AI in Education (AIED).

The authors highlight the potential of AIED to transform education by reducing teachers’ workload, providing contextualized learning for students, revolutionizing assessments, and developing intelligent tutoring systems. These aspects are crucial in the current digital age where technology is rapidly changing how we live and work.

The paper also discusses the ethical dimension of AIED and the potential impact of the Covid-19 pandemic on the future of AIED’s research and practice. This is particularly important as the integration of AI in education raises several ethical issues, including data privacy, algorithmic bias, and the digital divide.

At the end of the article the authors conclude: **“Cutting edge AI by researchers and companies around the world is not of much use if it is not helping the primary grade student in learning. This problem becomes extremely challenging because every learner is unique with different learning pathways. With the recent developments in AI, particularly reinforcement learning techniques, the future holds exciting possibilities of where AI will take education. For impactful AI in education, learners and teachers always need to be at the epicenter of AI development.”**

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[9] Chaudhry, M.A., Kazim, E. "Artificial Intelligence in Education (AIED): a high-level academic and industry note 2021.", AI Ethics 2, 157–165 (2022).

2.2 THE CHANGE IN TEACHERS AND STUDENTS ROLES

AI tools in the field of education, deployed by well-trained and well-supported teachers can be invaluable for accelerating progress towards radical changes and transformations in the near future. AI can help foster the skills students will need to navigate and shape the future. "How AI can accelerate students' holistic development and make teaching more fulfilling"[10]

The AI in education (AIED) community is increasingly **exploring the impact of AI systems in online education.** For example, Roll and Wylie (2016) call for more involvement of AI systems in the communication between students and instructors, and in education applications outside school context. "The impact of artificial intelligence on learner–instructor interaction in online learning"[11]

Deep learning technology can be used to develop **intelligent tutoring systems**, personalized learning experiences, and improve student engagement and motivation. It has the potential to revolutionize the way we approach education and improve outcomes for students.

AI can help **enrich and speed-up the student-centered approach** that represents the core curricular requirement in modern curriculums, including Kosova curriculum. AI can be used to **personalize learning experiences**, which can help to resolve some of the challenges faced by traditional "one-size-fits-all" approaches to education. "How AI and Data Could Personalize Higher Education"[12]

AI systems can adapt to each student's individual learning needs and target instruction based on their strengths and weaknesses. This can help to create a more engaging and effective learning experience for students. AI can also be used to develop intelligent tutoring systems, which can provide students with customized support and instruction. This can help to accelerate progress towards inclusive learning that will prepare young people to thrive and shape a better future. AI can also assist teachers by providing them with valuable data and insights, which can help them to improve their teaching methods and materials. "43 Examples of Artificial Intelligence in Education"[13]

Affected by AI, **the roles of teachers and students will be deeply transformed** and this will change completely educational processes. The table below summarizes the main characteristics of teachers and student roles in industrial era and era of AI.

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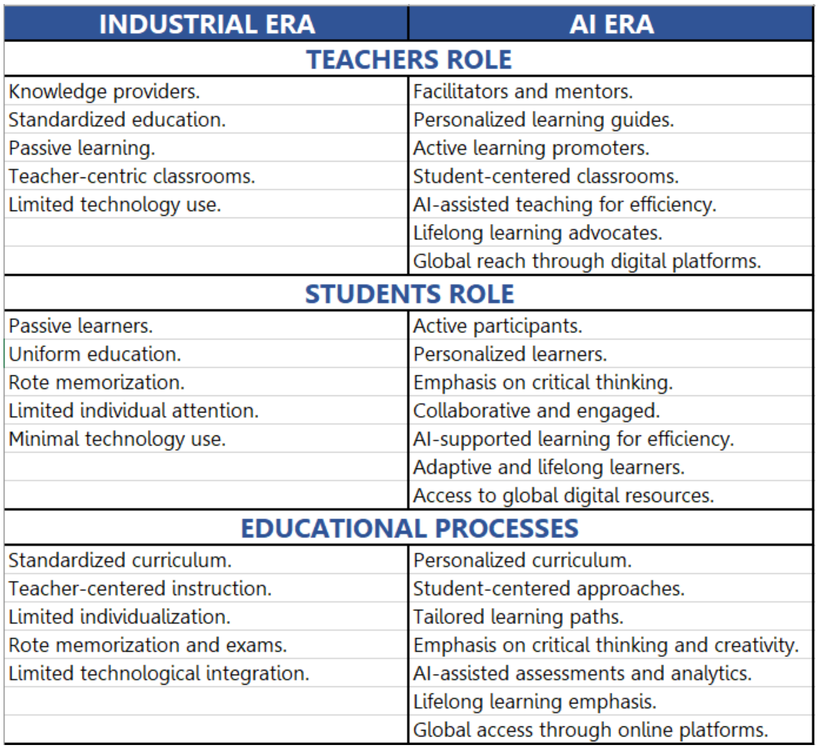
[10] World Economic Forum, "How AI can accelerate students' holistic development and make teaching more fulfilling", May 1, 2023

[11] Kyoungwon Seo, Joice Tang, Ido Roll, Sidney Fels & Dongwook Yoon, "The impact of artificial intelligence on learner–instructor interaction in online learning", International Journal of Educational Technology in Higher Education, 26 October 2021.

[12] Lasse Rouhiainen, "How AI and Data Could Personalize Higher Education", Harward Bussines Revew, October 14, 2019.

[13] University of San Diego, California, "43 Examples of Artificial Intelligence in Education", blog, 2023.



INDUSTRIAL ERA	AI ERA
TEACHERS ROLE	
Knowledge providers.	Facilitators and mentors.
Standardized education.	Personalized learning guides.
Passive learning.	Active learning promoters.
Teacher-centric classrooms.	Student-centered classrooms.
Limited technology use.	AI-assisted teaching for efficiency.
	Lifelong learning advocates.
	Global reach through digital platforms.
STUDENTS ROLE	
Passive learners.	Active participants.
Uniform education.	Personalized learners.
Rote memorization.	Emphasis on critical thinking.
Limited individual attention.	Collaborative and engaged.
Minimal technology use.	AI-supported learning for efficiency.
	Adaptive and lifelong learners.
	Access to global digital resources.
EDUCATIONAL PROCESSES	
Standardized curriculum.	Personalized curriculum.
Teacher-centered instruction.	Student-centered approaches.
Limited individualization.	Tailored learning paths.
Rote memorization and exams.	Emphasis on critical thinking and creativity.
Limited technological integration.	AI-assisted assessments and analytics.
	Lifelong learning emphasis.
	Global access through online platforms.

In summary, AI has the potential to transform the education system by providing students with personalized learning experiences, accelerating progress towards inclusive learning, and assisting teachers in their work. By using AI technologies correctly and ethically, we can create a more equitable and effective education system.

In the following chapters, I have tried to elaborate the core impacts of AIED that ultimately transforms the traditional education: redefines the roles of educators and learners, opens an unprecedented prospective of personalized, adaptive, and data-driven learning experiences, and provides for a more effective, inclusive, and innovative educational future.

2.3 AI POWERED PERSONALIZED LEARNING

The significance of AIED is immense, particularly when it comes to personal learning. AI has the potential to revolutionize the way we learn by providing personalized learning experiences tailored to each individual's needs and abilities. With AI, educational content can be customized to meet the specific needs and learning styles of each student. This means that students can learn at their own pace, focusing on the areas where they need the most help and skipping over material that they have already mastered.

AI can also help teachers to better understand their students' strengths and weaknesses, allowing them to provide more targeted instruction and feedback. This can lead to more effective teaching and improved student outcomes.

In addition, AI can help to make education more accessible by **providing personalized learning experiences for students with disabilities** or those who live in remote areas. With AI, these students can receive the same high-quality education as their peers, regardless of their location or abilities.

By providing customized content and targeted instruction, AI can help students to achieve their full potential and succeed in their academic pursuits.

Here are key ways in which AI can facilitate personalized learning:

- **Adaptive Learning Platforms**: AI-powered adaptive learning platforms can assess students' knowledge, skills, and learning styles through data analysis and provide tailored content and activities. These platforms can dynamically adjust the difficulty level, pace, and sequencing of learning materials to match each student's needs and optimize their learning experience. These platforms can provide adaptive assessments as well, that use AI algorithms to present questions based on the learner's responses adjusting the difficulty level to ensure an appropriate challenge and accurate assessment of their abilities. AI can adapt assessments to match students' learning levels and provide a more accurate representation of their knowledge and skills. "AI-Based Personalized E-Learning Systems: Issues, Challenges, and Solutions"[14]
- **Intelligent Tutoring Systems**: AI can enable intelligent tutoring systems that provide personalized guidance and support to students. These systems can analyze students' responses, track their progress, and offer individualized feedback, explanations, and additional resources to address their specific learning gaps or misconceptions. "Evolution and trends in intelligent tutoring systems research: a multidisciplinary and scientometric view"[15]
- **Learning Analytics**: AI can analyze large amounts of data, including student performance, behavior, and engagement patterns, to identify individual strengths, weaknesses, and learning preferences. Learning analytics can provide insights to teachers and learners, helping them

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[14] Mir Murtaza, Yamna Ahmed, Jawwad Ahmed Shamsi, Fahad Sherwani, Mariam Usman, "AI-Based Personalized E-Learning Systems: Issues, Challenges, and Solutions", | IEEE Xplore, 26 July 2022.

[15] Lu Guo, Dong Wang, Fei Gu, Yazheng Li, Yezhu Wang & Rongting Zhou, "Evolution and trends in intelligent tutoring systems research: a multidisciplinary and scientometric view", Asia Pacific Education Review, 2021.

understand progress, adapt instructional strategies, and make data-informed decisions. "Artificial Intelligence and Learning Analytics in Teacher Education: A Systematic Review")[16]

- **Natural Language Processing**: AI-powered Natural Language Processing (NLP) techniques can support personalized learning by enabling intelligent language-based interactions. NLP algorithms can understand and analyze students' written or spoken responses, provide automated feedback, and engage in dialogue, simulating a personalized tutoring experience. This can help students learn at their own pace and in their own style, improving their overall learning outcomes. "The Power of Natural Language Processing"[17]
- **Personalized Content Generation**: AI can generate personalized educational content based on individual needs and preferences. By analyzing student data and learning objectives, AI algorithms can create customized quizzes, exercises or learning materials that align with each learner's unique requirements. "Development Of An E-Learning System Based On Artificial Intelligence"[18]
- **Recommender Systems**: AI-driven recommender systems can suggest relevant learning resources such as books, articles, videos or online courses based on learners' interests, past performance and learning goals. These recommendations help students explore diverse topics and access materials that align with their specific areas of interest. "Artificial intelligence in recommender systems"[19]
- **Adaptive Assessments:** Adaptive assessments use AI algorithms to personalize the test to every examinee. This means that the test becomes shorter, more accurate, more secure, and fairer. "Computerized Adaptive Testing (CAT): An Introduction"[20] AI-powered assessments can adapt to the student's level of knowledge and provide immediate feedback. This can help teachers identify areas where students need additional support and adjust instruction accordingly. "Application of Artificial Intelligence (AI) In School Teaching and Learning Process- Review and Analysis"[21]
- **Individualized Progress Tracking**: AI can track and monitor individual student progress in real-time providing insights into their learning journey. Teachers and learners can access visualizations and reports that show areas of progress, areas of difficulty and trends over time enabling

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[16] Sdenka Zobeida Salas-Pilco,Kejiang Xiao and Xinyun Hu, "Artificial Intelligence and Learning Analytics in Teacher Education: A Systematic Review", MDPI Education Sciences.

[17] Ross Gruetzemacher, "The Power of Natural Language Processing", Harward Business Review, April 19, 2022.

[18] Dr. Sheetalrani R Kawale, Ms.P.Divya Laxmi, Dr Shekhar R, Parismita Sarma, Dr. Lingeshwaran N5, B. Kameswara Rao, "Development Of An E-Learning System Based On Artificial Intelligence", Journal of Positive School Psychology, 2022.

[19] Qian Zhang, Jie Lu & Yaochu Jin, "Artificial intelligence in recommender systems", Complex & Intelligent Systems, 2020.

[20] Nathan Thompson, "Computerized Adaptive Testing (CAT): An Introduction", Assessment Systems Corporation (ASC), MAY 21, 2019.

[21] S. B. Vinay, "Application of Artificial Intelligence (AI) In School Teaching and Learning Process- Review and Analysis", International Journal of Information Technology and Management Information Systems (IJITMIS), 14(1), 2023, pp. 1-5.

targeted interventions and personalized support. "DIGITAL TOOLS FOR REAL-TIME DATA COLLECTION IN EDUCATION"[22]

Overall AI's ability to analyze data, adapt instruction and provide tailored feedback enables personalized learning experiences that cater to the unique needs, interests and abilities of each learner. By leveraging AI educators can create more engaging effective and individualized learning environments.

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[22] Emily Gustafsson-Wright, Sarah Osborne, and Muskan Aggarwal, "DIGITAL TOOLS FOR REAL-TIME DATA COLLECTION IN EDUCATION", BROOKINGS, November 2022.

2.4 ENHANCED STUDENT ENGAGEMENT

AI-powered educational tools and platforms can make learning more interactive and engaging. Virtual reality, gamification, and intelligent tutoring systems can captivate students' attention, promote active participation, and increase motivation. Here are key ways in which AI can help improve student engagement:

- **Gamification**: AI-powered educational platforms can incorporate gamification elements such as points, badges, leaderboards, and rewards to make learning more engaging and interactive. Gamified experiences motivate students to actively participate, compete, and progress in their learning journeys. "The impact of gamification in educational settings on student learning outcomes: a meta-analysis"[23]
- **Virtual Reality (VR) and Augmented Reality (AR)** (AR - a technology that combines real-world environments with computer-generated elements): AI can enhance student engagement through immersive experiences using VR and AR technologies. Virtual simulations, 3D models, and interactive visualizations enable students to explore complex concepts, environments, and scenarios promoting active learning and curiosity. "The Promise of Immersive Learning: Augmented and Virtual Reality's Potential in Education"[24]
- **Natural Language Processing (NLP)**: AI-driven NLP algorithms can enable conversational interactions between students and intelligent virtual assistants or chatbots. These systems can engage in dialogue, answer questions, provide explanations, and support students in a conversational and interactive manner fostering engagement and deeper understanding. "The Power of Natural Language Processing"[25]
- **Personalized Recommendations**: AI can provide personalized recommendations for learning resources, activities or topics based on students' interests, learning preferences, and past interactions. By suggesting relevant and engaging content AI helps students explore topics they are interested in and promotes active participation in the learning process. "Personalized Online Learning Resource Recommendation Based on Artificial Intelligence and Educational Psychology"[26]
- **Interactive Learning Tools**: AI-powered interactive learning tools such as adaptive quizzes virtual labs and interactive exercises can engage students by providing immediate feedback allowing for exploration and creating interactive experiences. These tools make learning more

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[23] Rui Huang, Albert D. Ritzhaupt, Max Sommer, Jiawen Zhu, Anita Stephen, Natercia Valle, John Hampton & Jingwei Li, "The impact of gamification in educational settings on student learning outcomes: a meta-analysis", Educational Technology Research and Development, 2020.

[24] Ellysse Dick, ITIF (Information Technology & Innovation Foundation), "The Promise of Immersive Learning: Augmented and Virtual Reality's Potential in Education", August 30, 2021.

[25] Ross Gruetzemacher, Harward Business Review (HBR), "The Power of Natural Language Processing", April 19, 2022.

[26] Xin Wei, Shiyun Sun, Dan Wu, Liang Zhou, FRONTIERS, "Personalized Online Learning Resource Recommendation Based on Artificial Intelligence and Educational Psychology", 23 December 2021.

dynamic, interactive and hands-on. "AI Tools in Teaching and Learning - Guidance on understanding how AI tools can impact teaching and learning"[27]

- **Intelligent Feedback and Assessment**: AI can provide timely and personalized feedback on students' work assignments or assessments. Automated feedback systems analyze student responses identify errors or misconceptions and provide targeted feedback allowing students to reflect, learn from their mistakes and improve their performance. "Artificial Intelligence for Assessment and Feedback to Enhance Student Success in Higher Education"[28]
- **Adaptive Learning Experiences**: AI-powered adaptive learning platforms can dynamically adjust the content pace and difficulty level of instruction based on individual student needs. This personalized approach ensures that students are appropriately challenged which can increase their engagement and motivation to learn. "Personalized adaptive learning: an emerging pedagogical approach enabled by a smart learning environment"[29]
- **Multimodal Learning**: AI can facilitate multimodal learning experiences that cater to diverse learning preferences and styles. By integrating text audio video and interactive elements AI-powered platforms provide multiple means of engagement accommodating different learners' preferences and promoting active participation. "Multimodal Technologies in Precision Education: Providing New Opportunities or Adding More Challenges?"[30]
- **Collaborative Learning Support**: AI can facilitate collaborative learning experiences by providing intelligent support and feedback during group activities. AI algorithms can analyze group dynamics track individual contributions and offer insights or suggestions to enhance collaboration and engagement among students. "Engagement in cloud-supported collaborative learning and student knowledge construction: a modeling study"[31]
- **Emotional Recognition and Support**: AI can detect and analyze emotional cues such as facial expressions or tone of voice to understand students' emotional states. This information can be used to provide appropriate emotional support tailored interventions or adaptive strategies to enhance student engagement and well-being. "This AI reads children's emotions as they learn"[32]

By leveraging AI technologies educators can create engaging and interactive learning experiences that captivate students' attention and promote active participation in the learning process.

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[27] Stanford University, "AI Tools in Teaching and Learning - Guidance on understanding how AI tools can impact teaching and learning", April 21, 2023.

[28] Monika Hooda, Chhavi Rana, Omdev Dahiya, Ali Rizwan and Md Shamim Hossain, Academic Editor: Vijay Kumar, "Artificial Intelligence for Assessment and Feedback to Enhance Student Success in Higher Education", Hindawi, Mathematical Problems in Engineering, 05 May 2022.

[29] Hongchao Peng, Shanshan Ma & Jonathan Michael Spector, "Personalized adaptive learning: an emerging pedagogical approach enabled by a smart learning environment", Smart Learning Environments, 18 September 2019.

[30] Umar Bin Qushem, Athanasios Christopoulos, Solomon Sunday Oyelere, Hiroaki Ogata and Mikko-Jussi Laakso, "Multimodal Technologies in Precision Education: Providing New Opportunities or Adding More Challenges?", MDPI Education Sciences, 7 July 2021.

[31] Noria Saeed Baanqud, Hosam Al-Samarraie, Ahmed Ibrahim Alzahrani & Osama Alfarraj, "Engagement in cloud-supported collaborative learning and student knowledge construction: a modeling study", Springer Open, 17 December 2020.

[32] Milly Chan, "This AI reads children's emotions as they learn", CNN Business, 17, 2021.

2.5 DATA-DRIVEN DECISION MAKING

AI facilitates data collection and analysis, providing educators and policymakers with valuable insights into student performance, learning patterns, and areas for improvement. Data-driven decision making helps identify effective teaching strategies, allocate resources efficiently, and develop evidence-based policies. AI can significantly contribute to data-driven decision making in various ways. Here's how AI can help in this context:

- **Data Analysis and Insights:** AI can process and analyze vast amounts of data quickly and efficiently. Machine learning algorithms can identify patterns, trends, and correlations within the data, providing valuable insights and information that can inform decision making. "DIGITAL TOOLS FOR REAL-TIME DATA COLLECTION IN EDUCATION"[33]
- **Predictive Analytics:** AI algorithms can utilize historical data to make predictions and forecasts about future outcomes. By analyzing patterns and trends, AI can provide valuable predictive insights that can guide decision making, such as predicting student performance, identifying at-risk students, or forecasting resource needs. For example, predictive analytics can be used to tackle issues such as graduation and dropout rates. By applying advanced analytics to parameters such as absenteeism, course completion, and overall grade point average, schools can determine whether or not a student that fits a certain pattern is likely to graduate or not. "Predictive Analytics in Education: How Can It Help?"[34]
- **Real-Time Monitoring:** Real-time monitoring in education is a powerful tool that can help decision-makers have up-to-date information at their fingertips, enabling timely decision-making and the ability to respond quickly to emerging situations or trends. AI-powered systems can monitor data in real-time, providing valuable insights into student performance, resource needs, and other important metrics. For example, real-time performance data can be used to track program activities and the progress of instructors and learners, allowing administrators to adaptively manage resources and tailor programs according to the needs of students and instructors. Instructors can use student data to ensure that they are teaching at the right level and customize their instruction based on individual learning patterns and needs. Students and families can use real-time data to track progress and use this information to advocate for their needs.[33]
- **Adaptive Learning Systems:** are educational methods that use computer algorithms and AI to orchestrate the interaction with the learner and deliver customized resources and learning activities to address the unique needs of each learner. These systems can collect data on students' learning behaviors, preferences, and performance, and use this data to adapt instruction and tailor learning experiences to individual needs, optimizing the learning process and improving outcomes. AI-powered adaptive learning platforms analyze student data, such as their performance, strengths, weaknesses, and learning pace. Based on this information, the system can

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[33] Emily Gustafsson-Wright, Sarah Osborne, and Muskan Aggarwal, "DIGITAL TOOLS FOR REAL-TIME DATA COLLECTION IN EDUCATION", BROOKINGS, November 2022.

[34] Manos Stefanakos and Rajiv Velury, "Predictive Analytics in Education: How Can It Help?", AnalyticVue, July 29, 2022.

provide personalized learning pathways for each student, offering appropriate content, resources, and activities that align with their specific needs. "How to build an adaptive learning system"[35]

AI has various applications in decision-making processes. It can offer decision support by presenting pertinent data and insights to decision makers, aiding policymakers, educators, and administrators. Through AI-powered systems, complex data can be simplified for better understanding, streamlining informed decision making.

Moreover, AI automates report and dashboard generation, providing visual representations of crucial data. This saves time and enhances data comprehension for decision makers. AI also aids in risk assessment by analyzing data to identify potential issues. For example, it can detect early signs of academic or behavioral problems, enabling timely intervention and targeted support.

Resource optimization is another benefit of AI, as it can analyze diverse factors like student performance, resource usage, and budget limitations. By doing so, AI suggests more efficient resource allocation, improving resource management and cost-effectiveness.

Additionally, AI systems continually learn and enhance themselves by assessing decision outcomes. This ongoing learning process helps in identifying areas for improvement, refining decision-making processes, and achieving better results in the future.

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[35] Kevin Heis, "How to build an adaptive learning system", freeCodeCamp, AUGUST 22, 2019.

2.6 INTELLIGENT CONTENT CREATION AND CURATION

AI can automate content creation process, making it faster and more efficient. Natural Language Processing (NLP) algorithms can generate educational materials, including quizzes, essays, and interactive lessons. This enables educators to focus on higher-level tasks like critical thinking and problem-solving.

AI can be utilized for intelligent content creation in various ways, revolutionizing the way educational materials are generated. Here's how AI can contribute to intelligent content creation:

- **Interactive Multimedia Content:** AI-powered tools can generate interactive multimedia content, including videos, simulations, and visualizations. These dynamic and engaging resources help students grasp complex concepts, enhancing their understanding and knowledge retention.
  By leveraging AI for intelligent content creation, educators can access a wealth of generated materials, adapt instruction to individual needs, and provide engaging and interactive resources that enhance the learning experience for students.
  The pioneering example of a tool providing fascinating capabilities of AI generated learning content is the NOLEJ, an AI-powered decentralized skills platform that generates interactive courseware and global knowledge graph. "OpenAI-Based Instructional Design Generator Nolej AI Now Available for Educators with Free Trial"[36]. The interactive micro-learnings generated by NOLEJ AI have been proven to outperform traditional static formats, improving the completion rate by 85% and the retention rate by 75%. NOLEJ provides an innovative and effective way for teachers to create engaging and interactive learning materials for their students. "NOLEJ Launches Ethical AI Authoring Tool for Educators, Now Available on Google Classroom")[37]
- **Automated Writing:** AI-powered natural language generation (NLG) algorithms have the potential to revolutionize the field of education. These algorithms can automatically generate written content, such as essays, reports, summaries, and explanations, by analyzing data and following predefined rules and patterns. Here are a few examples of how AI-powered NLG is being used in education. "The automated writing assistance landscape in 2021"[38]:
- **Creative Writing:** A study titled "Student-AI Creative Writing: Pedagogical Strategies for Applying Natural Language Generation in Schools"[39] explored how students can apply NLG to creative writing. The study found that students could use NLG to enhance their writing process and become better prepared for AI-enhanced writing jobs and other writing endeavors.
- **Automated Feedback**: AI-powered NLG can be used to provide automated feedback to students on their written work. This can save time for teachers and provide students with immediate feedback on their work.

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[36] Kristal Kuykendall, "OpenAI-Based Instructional Design Generator Nolej AI Now Available for Educators with Free Trial", Campus Technology, 03/29/23

[37] CISION PR Newswire, "NOLEJ Launches Ethical AI Authoring Tool for Educators, Now Available on Google Classroom" June 28, 2023.

[38] Cambridge University Press, "The automated writing assistance landscape in 2021", 09 July 2021.

[39] David James, Woo Yanzhi Wang, Hengky Susanto, "Student-AI Creative Writing: Pedagogical Strategies for Applying Natural Language Generation in Schools", ResearchGate, June 2022.

- **Content Curation:** AI can curate relevant and high-quality educational content from various sources.
  The article "Content curation with AI can improve learning outcomes"[40] on Dataconomy discusses how AI can be used to curate relevant and high-quality educational content from various sources. The article explains that by analyzing learner preferences, learning goals, and data on content effectiveness, AI algorithms can recommend appropriate resources, saving educators time and effort in finding and evaluating materials.
  The article also mentions that Educational Vision Technologies (EVT) has created a pair of services that make long-form video content more palatable for knowledge workers and university students. They utilize machine learning and tools that provide content curation with AI.
  The program was first designed with the needs of students with disabilities in mind but also helps abled students who are unable to attend class or who find the note-taking aid useful. EVT's founder and CEO, Monal Parmar, observes: **"Studies have shown that it takes more cognitive effort to take notes while trying to listen to a lecture than it does to play chess. It doesn't make sense for students to overexert their cognitive bandwidth to write everything from the whiteboard or chalkboard. Providing notes gives students the flexibility to take as few or as many notes as work best for them."** "AI-powered video curation makes learning more accessible"[41]
- **Manual curation of educational materials** can be utilized to provide a basis for enhancing AI automated curation tools. Manual curation is time-consuming and often requires substantial expertise, but it is instrumental in improving the structure and identification of educational materials. By involving experts in the field, such as educators and researchers, AI algorithms can be trained to curate relevant and high-quality educational content from various sources. By leveraging the expertise of educators and researchers in manual curation, AI algorithms can be trained to curate high-quality educational content that meets the needs of learners. This can save educators time and effort in finding and evaluating materials, while also ensuring that the content recommended by the AI algorithms is of high quality and relevant to the learner's needs and preferences.
  An illustrative example of manual curation is YouTube channel: ZGJOI - STEAM Education, created and maintained by the author of this paper and his spouse Kimete Dida from Kosova since 2015. Their YouTube channel contains a large collection of curated videos (over 2,300 videos) in the fields of Science, Technology, Engineering, Arts, and Mathematics (STEAM), dedicated to both, students and teachers. The educational goal of the channel is to foster curiosity and desire for self-learning.

Overall, the integration of AI into content creation is driving a transformative shift in education, enhancing engagement, personalization, and accessibility. It empowers educators to focus on higher-level aspects of teaching while ensuring that students receive enriched and dynamic learning experiences.

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[40] Kerem Gülen, "Content curation with AI can improve learning outcomes", DataConomy, July 14, 2022.

[41] Michael Hickins, "AI-powered video curation makes learning more accessible", diginomica, July 5, 2022.

2.7 PERSONALIZED FEEDBACK AND ASSESSMENT

AI can provide immediate and personalized feedback to students, helping them understand their progress and identify areas that require further attention. Automated grading systems can also streamline assessment processes, saving educators time and effort.

AI can play a significant role in providing personalized feedback and assessment to learners. Here's how AI can help in this context:

- **Automated Feedback:** AI-powered systems can automatically analyze student responses and provide immediate feedback. These systems can detect errors, misconceptions, or areas of improvement and offer tailored feedback to guide learners in understanding their mistakes and making necessary corrections. (Read more in:
    - "Can Automated Feedback Improve Teachers' Uptake of Student Ideas? Evidence From a Randomized Controlled Trial in a Large-Scale Online Course"[42],
    - "Explainable AI for Data-Driven Feedback and Intelligent Action Recommendations to Support Students Self-Regulation"[43],
    - "The impact of artificial intelligence on learner–instructor interaction in online learning"[44])
- **Rubric-based Assessment:** AI algorithms can assess student work based on predefined rubrics or criteria. This allows for consistent and objective evaluation, providing learners with specific feedback on how their work aligns with the given criteria and where improvements can be made. "Rubric development for AI-enabled scoring of three-dimensional constructed-response assessment aligned to NGSS learning progression"[45]
- **Multimodal Assessment:** AI can handle various forms of assessment, including text, images, audio, and video. By incorporating AI algorithms, educators can assess learners' performance in different modalities and provide personalized feedback based on the specific assessment requirements.
- **Formative Assessment Support:** AI can assist in formative assessment by continuously monitoring and providing feedback on learners' progress. By tracking their performance and identifying areas of improvement in real-time, AI-powered systems support ongoing learning and

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[42] Dorottya Demszky, Jing Liu, Heather C. Hill, Dan Jurafsky and Chris Piech, "Can Automated Feedback Improve Teachers' Uptake of Student Ideas? Evidence From a Randomized Controlled Trial in a Large-Scale Online Course", Educational Evaluation and Policy Analysis, May 8, 2023.

[43] Muhammad Afzaal, Jalal Nouri, Aayesha Zia, Panagiotis Papapetrou, Uno Fors, Yongchao Wu, Xiu Li, Rebecka Weegar, "Explainable AI for Data-Driven Feedback and Intelligent Action Recommendations to Support Students Self-Regulation", Frontiers in Artificial Intelligence, 12 November 2021.

[44] Kyoungwon Seo, Joice Tang, Ido Roll, Sidney Fels & Dongwook Yoon, "The impact of artificial intelligence on learner–instructor interaction in online learning", International Journal of Educational Technology in Higher Education, 26 October 2021.

[45] Leonora Kaldaras, Nicholas R. Yoshida, Kevin C. Haudek, "Rubric development for AI-enabled scoring of three-dimensional constructed-response assessment aligned to NGSS learning progression", Frontiers in Education, 25 November 2022.

allow for timely intervention. "An AI-Based System for Formative and Summative Assessment in Data Science Courses"[46]

- **Peer Feedback and Collaboration:** AI algorithms can facilitate peer feedback and collaboration by providing guidelines, prompts, or models for learners to assess and provide feedback to their peers' work. AI can analyze and aggregate peer feedback to offer additional insights and suggestions to both learners and educators.
- **Data Visualization:** AI can create visualizations and reports that present assessment data in a clear and accessible manner. This enables learners and educators to understand assessment results more easily, identify trends, and make data-informed decisions.
- **Learner-Instructor interaction:** The study "The impact of artificial intelligence on learner–instructor interaction in online learning"[47], outlines the following:
    - AI systems offer effective support for online learning and teaching, including personalizing learning for students, automating instructors' routine tasks, and powering adaptive assessments.
    - AI tutoring systems can provide personalized guidance, support, or feedback by tailoring learning content based on student-specific learning patterns or knowledge levels.
    - However, while the opportunities for AI are promising, the impact of AI systems on the culture of, norms in, and expectations about interactions between students and instructors are still elusive. In online learning, learner–instructor interaction (inter alia, communication, support, and presence) has a profound impact on students' satisfaction and learning outcomes. Thus, identifying how students and instructors perceive the impact of AI systems on their interaction is important to identify any gaps, challenges, or barriers preventing AI systems from achieving their intended potential and risking the safety of these interactions.
    - Findings show that participants envision adopting AI systems in online learning can enable personalized learner–instructor interaction at scale but at the risk of violating social boundaries.

Although AI systems have been positively recognized for improving the quantity and quality of communication, for providing just-in-time, personalized support for large-scale settings, and for improving the feeling of connection, there were concerns about responsibility, agency, and surveillance issues. These findings have implications for the design of AI systems to ensure explainability, human-in-the-loop, and careful data collection and presentation.

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[46] Pierpaolo Vittorini, Stefano Menini & Sara Tonelli, "An AI-Based System for Formative and Summative Assessment in Data Science Courses", International Journal of Artificial Intelligence in Education, 22 December 2020.

[47] Kyoungwon Seo, Joice Tang, Ido Roll, Sidney Fels & Dongwook Yoon, "The impact of artificial intelligence on learner–instructor interaction in online learning", International Journal of Educational Technology in Higher Education, 26 October 2021.

2.8 ACCESSIBILITY AND INCLUSION

AI technologies can enhance accessibility and inclusion in education. For students with disabilities, AI can provide adaptive learning environments, assistive technologies, and speech recognition tools. Language translation and transcription capabilities can facilitate learning for students from diverse linguistic backgrounds.

AI has the potential to enhance accessibility and inclusion in various ways, promoting equal opportunities for all learners. Here's how AI can contribute to accessibility and inclusion:

- **Assistive Technologies:** AI-powered assistive technologies, such as speech recognition, text-to-speech, and image recognition, can support learners with disabilities. These technologies can enable individuals with visual impairments, hearing impairments, or learning disabilities to access educational materials, participate in activities, and engage in learning experiences. (Read more in:
    - "Three Ways AI Is Improving Assistive Technology"[48]
    - "Text-to-Speech AI: Lifelike Speech Synthesis"[49]
    - "What is Speech Recognition?"[50]
- **Language Translation and Transcription:** AI can automatically translate educational content into different languages, allowing learners with limited proficiency in the language of instruction to access educational resources. Additionally, AI-powered transcription services can provide real-time captions or transcriptions of audio content, benefiting learners with hearing impairments or those who prefer textual representations.
    - "How does AI Translation Work + Best AI Translation Tools (2023)" [51]
    - "Recent advances in Apertium, a free/open-source rule-based machine translation platform for low-resource languages"[52]
- **Adaptive Learning Environments:** AI algorithms can create adaptive learning environments that cater to diverse learning styles and preferences. By analyzing learner data, AI can personalize instruction, content delivery, and learning experiences, ensuring that all learners have access to materials and activities that suit their individual needs. "Adaptive e-learning environment based on learning styles and its impact on development students' engagement"[53]
- **Personalized Accommodations:** AI has the potential to provide personalized accommodations for learners with disabilities. By analyzing individual needs and preferences, AI algorithms can generate customized adaptations, such as modified text formats, alternative content presentations, or personalized learning pathways, to support learners' unique requirements.

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[48] Wendy Gonzalez - Forbes, "Three Ways AI Is Improving Assistive Technology", Sep 21, 2021.

[49] "Text-to-Speech AI: Lifelike Speech Synthesis", Google Cloud.

[50] "What is Speech Recognition?", IBM.

[51] Matt Strach, "How does AI Translation Work + Best AI Translation Tools (2023)", BLEND, August 15 , 2023.

[52] Tanmai Khanna, Jonathan N. Washington, Francis M. Tyers, Sevilay Bayatlı, Daniel G. Swanson, Tommi A. Pirinen, Irene Tang & Hèctor Alòs i Font, "Recent advances in Apertium, a free/open-source rule-based machine translation platform for low-resource languages", Machine Translation, 18 October 2021.

[53] Hassan A. El-Sabagh, "Adaptive e-learning environment based on learning styles and its impact on development students' engagement", International Journal of Educational Technology in Higher Education, 01 October 2021.

For example, AI can help those involved in assessment identify disabilities in students, such as ASD, specific learning disabilities (dyslexia, dysgraphia, and dyscalculia), and attention-deficit/hyperactivity disorder (ADHD). With this information, AI can then provide personalized accommodations to support these learners. "AI used to support people with learning disabilities"[54]

- **Data-Driven Individualized Support:** AI algorithms can analyze learner data, including performance, behavior, and engagement patterns, to identify individual needs and provide targeted support. This data-driven approach enables educators to identify barriers to learning and implement personalized interventions to address specific challenges faced by learners. "AI Data-Driven Personalisation and Disability Inclusion"[55]
- **Inclusive Content Creation:** AI-powered content generation tools can facilitate the creation of inclusive educational materials. AI algorithms can be used to analyze content for bias, readability, and accessibility. This can help educators and content creators develop materials that are inclusive and culturally sensitive. For example, research shows that AI is often biased, but there are ways to make algorithms work for all of us. However, it is important to note that AI algorithms are only as good as the data they are trained on and the people who develop them. It is important to address the sources of fairness and non-discrimination risks in the use of AI, which include implicit bias, sampling bias, temporal bias, over-fitting to training data, and edge cases and outliers. By addressing these risks, AI algorithms can be used to help create more inclusive and culturally sensitive content. [56]
- **Collaboration and Peer Learning:** AI can foster collaboration and peer learning among diverse groups of learners. By facilitating communication, providing translation support, or promoting inclusive group dynamics, AI can create inclusive learning environments that encourage cooperation, shared understanding, and the exchange of ideas among learners from different backgrounds and abilities."The impact of artificial intelligence on learner–instructor interaction in online learning"[57]
- **Emotional Support and Mental Health:** AI-powered systems can analyze emotional cues, such as facial expressions or tone of voice, to detect learners' emotions and provide appropriate support. This can include offering encouragement, suggesting relaxation techniques, or notifying educators of potential emotional distress, enhancing the emotional well-being and inclusivity of the learning environment.
  - "Exploring the Effects of AI-assisted Emotional Support Processes in Online Mental Health Community"[58],

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[54] E&T editorial staff, "AI used to support people with learning disabilities", E&T - Engineering and Technology, May 9, 2022.

[55] Mike Wald, "AI Data-Driven Personalisation and Disability Inclusion", Frontiers in Artificial Intelligence, 18 January 2021.

[56] Agbolade Omowole, "Research shows AI is often biased. Here's how to make algorithms work for all of us", WEF, Artificial Inteligence, Jun 19, 2021.

[57] Kyoungwon Seo, Joice Tang, Ido Roll, Sidney Fels & Dongwook Yoon, "The impact of artificial intelligence on learner–instructor interaction in online learning", International Journal of Educational Technology in Higher Education, 26 October 2021.

[58] Donghoon Shin, Subeen Park, Esther Hehsun Kim, Soomin Kim, Jinwook Seo, Hwajung Hong, "Exploring the Effects of AI-assisted Emotional Support Processes in Online Mental Health Community", Cornell University, 21 Feb 2022.

  - "Optimizing Students' Mental Health and Academic Performance: AI-Enhanced Life Crafting"[59]
- **Advanced speech synthesis technologies**, which are based on machine learning models, are among the more promising applications of AI for students who rely on assistive technologies. For example, Educational Testing Service (ETS) used technologies from Amazon to replace some human recorded audio with synthesized speech for some supplemental test content.
- **Accessibility Testing and Compliance:** AI algorithms can assist in testing the accessibility and compliance of educational materials. By automating accessibility checks, AI can help ensure that digital content meets accessibility standards, making it more inclusive and usable for learners with disabilities.
  Automated accessibility testing is important for three reasons: More efficient accessibility compliance, better accuracy, and cost-effective. Automating accessibility testing involves using specialized tools and software to test various aspects of an application or website for accessibility compliance. There are several automated accessibility testing tools available, such as Axe, Google Lighthouse, and Wave. "In-Depth Guide to Accessibility Testing Automation in 2023"[60]
- **Content Descriptions:** AI techniques could be used to automatically describe images. AI-based systems could also be used to do a "first pass" at describing content.
- **Webpage Interactions:** AI-based tools can also be used to help with interactions by people who are unable to see content. A "seeing" AI, for example, could help students who find the contents of a webpage to be too visually stimulating. "ECAR Study of the Technology Needs of Students with Disabilities"[61]

By leveraging AI technologies, educational systems can become more inclusive and accessible, providing equitable learning opportunities for all learners, regardless of their abilities, backgrounds, or learning styles. AI has the potential to break down barriers, bridge gaps, and empower diverse learners to engage in meaningful educational experiences.

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[59] Izaak Dekker, Elisabeth M. De Jong, Michaéla C. Schippers, Monique De Bruijn-Smolders, Andreas Alexiou, Bas Giesbers, "Optimizing Students' Mental Health and Academic Performance: AI-Enhanced Life Crafting", Frontiers in Psychology, 03 June 2020.

[60] Altay Ataman, "In-Depth Guide to Accessibility Testing Automation in 2023", AIMULTIPLE, March 3, 2023.

[61] Dana C. Gierdowski and Joseph Galanek, "ECAR Study of the Technology Needs of Students with Disabilities", EDUCAUSE Research Notes, June 1, 2020.

2.9 LIFELONG LEARNING AND SKILLS DEVELOPMENT

Lifelong learning in the age of AI refers to the concept of continuous learning and development throughout one's life, enabled and enhanced by the use of AI technology. AI-powered tools support lifelong learning by offering personalized recommendations for further study, suggesting relevant resources, and facilitating continuous skill development. This is particularly important in a rapidly evolving job market that demands continuous upskilling and reskilling.

AI is transforming the way we learn by providing personalized learning paths, intelligent content recommendations, continuous skill assessment, skill gap analysis, lifelong learning analytics, and automation of repetitive tasks. These features enable individuals to continuously develop their skills and knowledge throughout their lives, facilitating self-directed learning and allowing individuals to explore new topics and acquire new skills.

AI-powered systems can generate bite-sized learning content and microlearning modules that allow learners to acquire knowledge in small, manageable chunks.

AI can also facilitate intelligent tutoring systems that provide personalized guidance and support to learners.

AI algorithms can analyze labor market trends, job requirements, and individual skills to identify skill gaps, guiding learners in selecting relevant learning opportunities and acquiring the skills in demand.

- "Ahead in the Cloud: Lifelong Learning in the Age of AI with John Domingue of Open University"[62],
- "Developing capabilities: Lifelong learning in the age of AI" [63],
- "Developing Personalized Education: A Dynamic Framework"[64]

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[62] John Domingue, podcast, "Ahead in the Cloud: Lifelong Learning in the Age of AI with John Domingue of Open University", Infosys Knowledge Institute, April 11, 2023.

[63] Poquet, O., & de Laat, M. (2021). "Developing capabilities: Lifelong learning in the age of AI", British Journal of Educational Technology, 00,1– 14, 19 May 2021.

[64] Leonard Tetzlaff, Florian Schmiedek & Garvin Brod, "Developing Personalized Education: A Dynamic Framework", Educational Psychology Review, 29 October 2020.

2.10 PREDICTIVE ANALYTICS AND EARLY INTERVENTION

AI can identify patterns and trends in student data, enabling early identification of struggling students. Predictive analytics can help educators intervene proactively, providing timely support and intervention to prevent academic difficulties and improve student success rates.

In this context AI algorithms can:

- **Analyze large amounts of data** to provide valuable insights into factors that may contribute to academic challenges or other issues.
- **Detect early signs** of academic or behavioral difficulties and trigger early interventions.
- **Assess various risk factors**, identify students who are more likely to experience academic or social difficulties, and provide recommendations for personalized interventions based on individual student needs.

AI-powered adaptive learning systems can:

- **Adapt instruction/tutoring** and provide targeted support based on ongoing performance data.
- **Provide decision support to educators** by synthesizing data and recommending appropriate interventions or strategies.
- **Facilitate early intervention** by involving parents and guardians in the process.
- **Build predictive models** based on historical data to forecast future outcomes and identify potential challenges.
- **Assist in optimizing** resource allocation by identifying specific areas or student groups that require additional support.

By leveraging predictive analytics and early intervention strategies powered by AI, educators and stakeholders can identify at-risk students, implement targeted interventions, and support their academic success and overall well-being. This proactive approach can lead to improved educational outcomes and enhanced support for students' individual needs.

3 HUMAN-CENTERED AIED

3.1 EMOTIONAL INTELLIGENCE AND AIED

Emotional intelligence (EI is essential for everyone, but significant for leaders and learners alike. Superiors and students dealing with challenging feedback, tight deadlines, relationship management, navigating change, and working through setbacks and failures could all benefit from establishing core emotional intelligence competencies. "To Learn and Lead: The Importance of Emotional Intelligence in Higher Education"[65]

It is important for good communication with others and is therefore a gateway to better learning, friendships, academic success and employment. Skills such as these developed in our formative years at school often provide the foundation for future habits later on in life. "Emotional intelligence: why it matters and how to teach it"[66]

In pre-university education, emotional intelligence play a significant role in students' academic performance. A study conducted on pre-university science students in Nigeria: "Impact of intrapersonal and interpersonal emotional intelligence and self-directed learning on academic performance among pre-university science students"[67], found that: **"We learned that students' emotional intelligence plays critical role in improving pre-university science students' academic achievement. This is an indication that students in the pre-university program who are lagging in their academics could be provided with intervention programs that can build on their emotional intelligence."**

In higher education, emotional intelligence skills are also important predictors of academic success, and they play a key role in students' performance.

Emotional intelligence can be said to cover five main areas: self-awareness, emotional control, self-motivation, empathy and relationship skills.

AI has the potential to contribute to fostering emotional intelligence skills in students in several ways:

- **Personalized Feedback and Assessment:** AI-driven educational platforms can provide personalized feedback to students based on their emotional responses and interactions. By analyzing students' emotional cues, such as facial expressions and tone of voice, AI can offer insights into their emotional states and suggest strategies for improving emotional intelligence.

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[65] Goodwin University, "To Learn and Lead: The Importance of Emotional Intelligence in Higher Education".

[66] Bradley Busch and Ben Oakley, "Emotional intelligence: why it matters and how to teach it", The Guardian, 3 Nov 2017.

[67] Emmanuel Nkemakolam Okwuduba, Kingsley Chinaza Nwosu, Ebele Chinelo Okigbo, Naomi Nkiru Samuel, Chinwe Achugbu, "Impact of intrapersonal and interpersonal emotional intelligence and self-directed learning on academic performance among pre-university science students" Heliyon, 24 March 2021.

- **Virtual Emotional Intelligence Coaches:** AI-powered virtual assistants or chatbots can serve as emotional intelligence coaches for students. These AI-driven coaches can engage students in conversations, provide guidance on managing emotions, and offer real-time feedback on their responses and emotional expressions.
- **Emotion Recognition Technology:** AI can be used to develop emotion recognition technology that can assess and analyze students' emotions during learning activities. This technology can help educators better understand their students' emotional states and tailor their teaching approaches accordingly.
- **Emotional Learning Apps and Games:** AI can be integrated into educational apps and games designed to teach emotional intelligence skills. These apps can use AI to adapt to individual student needs and provide engaging experiences that promote self-awareness, empathy, and emotional regulation.
- **Data-Driven Insights:** AI can analyze large datasets of student interactions and emotional responses to identify trends and patterns in emotional intelligence development. This information can inform educators and policymakers on effective strategies for teaching emotional intelligence.
- **Virtual Reality (VR) and Augmented Reality (AR):** AI-powered VR and AR experiences can immerse students in emotionally challenging scenarios, allowing them to practice and develop emotional intelligence in a safe and controlled environment.
- **Personalized Content Recommendations:** AI algorithms can recommend reading materials, videos, and other resources that align with a student's emotional intelligence goals and learning style, facilitating self-directed learning in this domain.

However, it's important to note that while AI can be a valuable tool in fostering emotional intelligence skills, it should complement rather than replace human interaction and guidance. Emotionally intelligent educators and mentors play a crucial role in modeling and teaching emotional intelligence skills through real-life interactions and support. AI should be used to enhance and support these efforts, providing additional resources and insights to promote emotional intelligence development in students. Additionally, ethical considerations regarding data privacy and the responsible use of AIED must be carefully addressed to ensure the well-being of students.

3.2 CULTIVATING A GROWTH MINDSET

Growth vs fixed mindset is a comparison of how people view their intelligence, abilities, and talents. Growth mindset means believing that these traits can be learned and improved through effort, while fixed mindset means believing that these traits are stable and unchangeable over time. Growth mindset leads to resilience, commitment, problem-solving, and lifelong learning, while fixed mindset leads to self-limitation, giving up, negative feedback, and low motivation. "GROWTH MINDSET VS. FIXED MINDSET: WHAT'S THE DIFFERENCE?"[68]

Psychologist Carol Dweck from Stanford University, made the idea of fixed vs. growth mindsets famous with her book "Mindset: The New Psychology of Success"[69]. Through extensive research, she found that there are two common mindsets, or ways of thinking: "Growth Mindset vs. Fixed + Key Takeaways From Dweck's Book"[70]

- **Fixed mindset:** People with a fixed mindset feel that their abilities are what they are and cannot be changed. For instance, a person may believe that they're bad at reading, so they don't bother to try. Conversely, a person may feel that because they're smart, they don't need to work very hard. In either case, when a person fails at something, they simply give up.
- **Growth mindset:** Those with this mindset believe that they can always learn new things if they make enough effort. They embrace their mistakes, learning from them and trying new ideas instead. They're not afraid to fail and try again. Dweck found that successful people are those who embrace a growth mindset. Individuals with growth mindsets believe effort is one of the most important things in life for achievement. They say the harder you work at something, the better you'll be at it. "Growth Mindset vs Fixed Mindset: How what you think affects what you achieve"[71]

Though we all alternate between the two at times, focusing on a growth-oriented way of thought and behavior helps people adapt and change when needed. Instead of thinking **"I can't do this,"** these people say, **"I can't do this YET."**

Growth mindset is key for learners. They must be open to new ideas and processes and believe they can learn anything with enough effort. It sounds simplistic, but when students really embrace the concept, it can be a real game-changer. "Growth Mindset vs. Fixed Mindset: A Practical Guide for Teachers"[72]

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[68] Catherine Cote, "GROWTH MINDSET VS. FIXED MINDSET: WHAT'S THE DIFFERENCE?", Harvard Business School, 10 MAR 2022.

[69] Carol S. Dweck, "The New Psychology of Success", Random House Publishing Group, 2006.

[70] Courtney E. Ackerman, MA., Scientifically reviewed by Jo Nash, Ph.D., "Growth Mindset vs. Fixed + Key Takeaways From Dweck's Book", PositivePsychology.com, 3 Apr 2018.

[71] Jennifer Smith, "Growth Mindset vs Fixed Mindset: How what you think affects what you achieve", MINDSET HEALTH, September 25, 2020.

[72] Jill Staake, "Growth Mindset vs. Fixed Mindset: A Practical Guide for Teachers", We Are Teachers, MAR 20, 2023.

According to the "PISA 2018 Results (Volume III) : What School Life Means for Students' Lives - Chapter 14. Growth mindset"[73], a majority of students disagreed or strongly disagreed with the statement **"Your intelligence is something about you that you can't change very much"**, on average across OECD countries. However, at least 60% of students in Kosova, the Dominican Republic, Indonesia, the Republic of North Macedonia, Panama and the Philippines agreed or strongly agreed with that statement.

This suggests that a significant proportion of students in Kosova hold a fixed mindset, or the belief that someone is born with a certain degree of ability and intelligence that is nearly unaltered by experience. In contrast, a growth mindset, or incremental theory of intelligence, is the belief that someone's ability and intelligence can develop over time.

Holding a growth mindset has been shown to be positively related to students' motivation to master tasks, general self-efficacy, learning goals, and perceived value of schooling, while negatively related to their fear of failure.

AI can play a significant role in promoting and embodying growth mindset attitudes. AI is considered a growth mindset moment for everyone, including those who design it and those who use and experience it. This is because AI, unlike traditional software, continually learns from data and improves over time. "Why Growth Mindset Is Needed With AI – 10 Examples of Carol Dweck's Principles for an Existential Moment"[74]

The journey towards developing effective and safe AI with a growth mindset requires a commitment to continuous improvement, a readiness to confront challenges, and a dedication to the responsible advancement of technology.

For instance, deploying AI early in real-world scenarios, rather than in controlled environments, can help generate more data that feeds back into the development process. This approach initiates a continuous feedback loop through which the algorithm is enriched by new data.

In essence, AI's ability to learn and adapt embodies the principles of a growth mindset, which believes in the capacity for intelligence to grow with effort and the right learning strategies. "Developing Effective and Safe AI With a Growth Mindset"[75]

Here's how AI can contribute to promoting a growth mindset:

- **Personalized Feedback:** AI-powered educational platforms can provide personalized feedback to students, emphasizing the importance of effort and perseverance in the learning process. By highlighting their progress and improvement over time, AI can reinforce the idea that abilities can be developed through dedication and hard work.

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[73] OECD, "PISA 2018 Results (Volume III) : What School Life Means for Students' Lives - Chapter 14. Growth mindset"

[74] Michael Gale, "Why Growth Mindset Is Needed With AI – 10 Examples of Carol Dweck's Principles for an Existential Moment", Forbes, May 1, 2023.

[75] Tero Ojanperä and Timo Vuori , Aalto University, and Quy Huy , INSEAD, "Developing Effective and Safe AI With a Growth Mindset", 16 Jun 2023.

- **Adaptive Learning:** AI can adapt learning materials and challenges based on a student's performance and learning pace. When students encounter challenging tasks that are within their reach but require effort to complete, it encourages them to embrace challenges and see them as opportunities for growth.
- **Positive Reinforcement:** AI-driven systems can use positive reinforcement techniques to reward and motivate students when they demonstrate a growth mindset. This can include providing digital badges, certificates, or encouraging messages when students persist in their efforts or overcome obstacles.
- **Mindset Assessment:** AI can assess students' mindsets through various means, such as analyzing their responses to challenges, quizzes, or self-assessment surveys. This information can be used to tailor interventions and feedback to help students develop a growth mindset.
- **Growth-Oriented Content Recommendations:** AI algorithms can recommend resources, articles, videos, or books that promote a growth mindset. These recommendations can expose students to stories and content that inspire them to embrace challenges and see failures as learning opportunities.
- **Virtual Mentors and Role Models:** AI-powered virtual mentors or role models can share stories and experiences of individuals who have achieved success through perseverance and continuous learning. These narratives can inspire students to adopt a growth mindset.
- **Goal Setting and Progress Tracking:** AI can assist students in setting achievable goals and tracking their progress toward those goals. This process reinforces the idea that progress is possible through effort and determination.
- **Social Learning and Collaboration:** AI can facilitate collaborative learning experiences where students work together on projects and share their experiences. This can create a supportive environment that encourages the exchange of growth mindset ideas.

While AI can be a valuable tool in promoting a growth mindset, it's essential to remember that nurturing a growth mindset also requires the involvement of teachers, mentors, and parents. These individuals can provide guidance, encouragement, and real-life examples of growth mindset behavior.

In conclusion, AI should be integrated into a holistic educational approach[76] that combines technology with human support to effectively instill and reinforce a growth mindset in learners.

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[76] A holistic educational approach, also known as holistic education, is an educational philosophy that aims to address the development of the whole person, rather than focusing solely on academic knowledge or skills. It considers the intellectual, emotional, social, physical, and spiritual aspects of a student's development.

3.3 INNER VALUES, MENTAL HEALTH AND SOFT SKILLS

AI can foster inner values, mental health, soft skills and promote social entrepreneurship, thereby transforming the educational landscape.

Inner Values: AI can play a significant role in fostering inner values in education. It can be used to create personalized learning experiences that focus on developing empathy, compassion, and ethical decision-making. AI-powered platforms can analyze a student's behavior, emotions, and social interactions to provide insights into their emotional and moral development. This data can then be used to tailor educational content that nurtures these inner values.

Mental Health: Inner values are closely linked with mental health. Empathy, compassion, and ethical decision-making can contribute to better mental health by promoting positive social interactions and reducing stress. AI can support mental health in education by providing tools that help students understand and manage their emotions, develop resilience, and build strong relationships.

Soft Skills: Soft skills such as communication, teamwork, problem-solving, and adaptability are increasingly important in today's world. These skills are often rooted in inner values. AI can help foster these soft skills by providing interactive learning experiences that challenge students to communicate effectively, work collaboratively, solve problems creatively, and adapt to new situations.

3.4 SOCIAL ENTREPRENEURSHIP

Social entrepreneurship is about applying innovative solutions to social problems. AI can support this by providing tools that help identify social issues, generate innovative ideas, and implement effective solutions. For example, AI can analyze vast amounts of data to identify patterns and trends related to social issues. This information can then be used by social entrepreneurs to develop targeted interventions.

Moreover, AI can also assist in the operational aspects of social entrepreneurship. It can automate administrative tasks, improve communication and collaboration, and provide predictive analytics for better decision-making.

Ashoka Changemakers: Bill Drayton, the founder of Ashoka, has been instrumental in promoting the concept of "Every Child a Changemaker". This idea emphasizes the importance of nurturing empathy, creativity, thoughtfulness, leadership, and teamwork in children from a young age. By doing so, it aims to equip them with the skills necessary to thrive in a rapidly changing world and find innovative solutions to complex problems.

Bill Drayton has emphasized the importance of every child being a changemaker. He believes that everyone needs to become a changemaker in order to truly thrive. He stated that **"Being a changemaker is absolutely critical"**.

In an interview about Ashoka Fellowship program: "The Bill Drayton interview: The story behind how the Ashoka Fellowship was created after a roadtrip to India"[77], Bill Drayton shared his belief that **"Everyone can be a changemaker and it is never too early too start"**. He further explained that more than half of Ashoka's 3,000 fellows started a venture or a project in their teens. This highlights the importance of nurturing changemaking skills from a young age.

Drayton also said, **"In a world where the rate of change is escalating exponentially — as is the extent to which we are interconnected — everyone must be a changemaker to be able to give, to be a player. Indeed, it is no longer possible to be a good and therefore accepted person by diligently following the rules. The rate of change is just too fast. Therefore, we must have conscious empathy and be guided by it. That is the only way we will not hurt others and not disrupt groups. It's the only way that we can build the other abilities necessary to be a contributor in this new reality."**

When talking about kids of disadvantaged communities he strongly argues: **"If a disadvantaged community does this, their kids are going to be extraordinarily successful in the "everyone a changemaker" world. The demand for changemakers far outstrips the supply. Anyone with these abilities will never have a jobs problem. Sadly, however,**

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[77] Seema Rajpal, EDEX Live, "The Bill Drayton interview: The story behind how the Ashoka Fellowship was created after a roadtrip to India", 19th January 2021.

disadvantaged communities are less likely to give their kids this superpower. They can. We should, as a completely urgent matter, ensure that they can and do. Especially because we know what to do and because it's so simple and so proven, it is criminal to allow any young person to grow up without the new abilities they will require to be able to be a contributor, a giver, a powerful person, that is, a changemaker, in the new everything-changing reality."

In conclusion, AI has the potential to foster inner values, mental health, soft skills and promote social entrepreneurship in education. By personalizing learning experiences, providing valuable insights into mental health and soft skills development, supporting operational efficiency in social entrepreneurship endeavors, AI can significantly enhance the educational landscape and bring positive change in society.

3.5 ETHICAL AND RESPONSIBLE USE OF AIED

AI in education sparks important discussions about ethics. As we explore the possibilities of AI in education, it's crucial to focus on the ethical aspects of this transformation. Our collective responsibility, as policymakers and educators, is to navigate these uncharted waters while safeguarding the principles of ethical conduct and ensuring that AI technologies are deployed with the utmost responsibility.

- "Ethical principles for artificial intelligence in education"[78]
- "Ethics of AIED: Towards a Community-Wide Framework"[79]
- "How Should We Approach the Ethical Considerations of AI in K-12 Education?"[80]

Let's see below why ethical issues occupy such an important place.

- **Mitigating Bias and Discrimination:** AI systems can inadvertently perpetuate biases present in the algorithms and data they are trained on, leading to discriminatory outcomes. Ethical considerations ensure that AI is designed and used in a way that avoids bias, promotes fairness, and safeguards against discrimination based on factors such as race, gender, or socioeconomic status. "Open source data science: How to reduce bias in AI"[81]
- **Protecting Privacy and Data Security:** AI relies on vast amounts of data, often including personal and sensitive information. Ethical practices involve implementing robust data protection measures, respecting privacy rights, and ensuring that data is securely handled, stored, and used only for legitimate purposes. "Protecting privacy in an AI-driven world"[82]
- **Transparency and Explainability:** Ethical use of AI requires transparency and explainability. Users should have a clear understanding of how AI systems make decisions and the factors considered in their algorithms. This transparency fosters trust, allows for accountability, and enables users to challenge or question AI-generated outcomes. "AI Can Be Both Accurate and Transparent"[83]
- **Accountability and Responsibility:** Ethical considerations emphasize accountability and responsibility in the development, deployment, and use of AI. Stakeholders must be accountable for the decisions made by AI systems and take responsibility for the potential impacts on

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[78] Andy Nguyen, Ha Ngan Ngo, Yvonne Hong, Belle Dang & Bich-Phuong Thi Nguyen, "Ethical principles for artificial intelligence in education", Education and Information Technologies, 13 October 2022.

[79] Wayne Holmes, Kaska Porayska-Pomsta, Ken Holstein, Emma Sutherland, Toby Baker, Simon Buckingham Shum, Olga C. Santos, Mercedes T. Rodrigo, Mutlu Cukurova, Ig Ibert Bittencourt & Kenneth R. Koedinger, "Ethics of AIED: Towards a Community-Wide Framework", International Journal of Artificial Intelligence in Education , 09 April 2021.

[80] Nancye Blair Black, "How Should We Approach the Ethical Considerations of AI in K-12 Education?", EdSurge, Oct 25, 2021.

[81] Abby Seneor, Matteo Mezzanotte, "Open source data science: How to reduce bias in AI", WEF

Oct 14, 2022.

[82] Cameron F. Kerry, "Protecting privacy in an AI-driven world", BROOKINGS, February 10, 2020.

[83] François Candelon, Theodoros Evgeniou, and David Martens, "AI Can Be Both Accurate and Transparent", Harvard Business Review, May 12, 2023.

individuals, communities, and society as a whole. "Accountability in AI: From Principles to Industry-specific Accreditation"[84]

- **Human-Centric Design:** Ethical AI emphasizes human well-being and user needs. AI systems should be designed to enhance human capabilities, empower individuals, and prioritize human values, ensuring that AI technology serves as a tool for the betterment of society rather than a source of harm or control. "Human-Centered AI for Data Science: A Systematic Approach"[85]
- **Addressing Unintended Consequences:** Ethical practices require careful consideration of the potential unintended consequences of AI. AI systems can have far-reaching impacts, both positive and negative, on various aspects of society. Ethical approaches involve actively identifying and mitigating potential risks, ensuring that AI benefits outweigh any adverse effects. "5 Rules to Manage AI's Unintended Consequences"[86]

  The paper "AI ethics to work: are the tools fit for purpose?"[87] by Jacqui Ayling and Adriane Chapman, published in AI Ethics, reviews the landscape of suggested ethical frameworks for AI systems, which is a multidimensional and extremely complex issue: **"This work provides an assessment of the myriad of frameworks, principles, templates, guidelines and protocols that have arisen around AI through the lens of known best practices for impact assessment and audit of technology. We as a community have taken the first steps in identifying that there is a problem to be addressed and started to identify how to apply this by proposing tools to manage ethical challenges and risks."**

- **Ensuring Accountability in Decision-Making:** AI systems can make autonomous decisions or assist in decision-making processes. Ethical use of AI involves ensuring that individuals and organizations remain accountable for the decisions made by AI, with appropriate oversight, human judgment, and the ability to challenge or appeal automated decisions.
- **Continuous Monitoring and Evaluation:** Ethical considerations necessitate ongoing monitoring and evaluation of AI systems to identify and address any emerging ethical issues or biases. This iterative process enables organizations to learn from mistakes, improve algorithms, and ensure that AI remains aligned with ethical standards and societal values.
- **Preserving Trust in AI:** Ethical practices are essential for preserving public trust in AI. Trust is crucial for widespread acceptance and adoption of AI technologies. Ethical use of AI promotes transparency, fairness, and accountability, fostering trust among users, stakeholders, and the broader public.

When we talk about the infusion of AI in education, a simple technical approach is absolutely in-admissible. Through prioritizing ethical considerations in the development and deployment of AI, we can ensure that AI technologies are harnessed in a manner that aligns with human values, respects individual rights, and contributes to the overall betterment of society. Ethical practices are essential to maximize the benefits of AI while minimizing potential harms and ensuring a more equitable and inclusive future.

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[84] Chris Percy, Simo Dragicevic, Sanjoy Sarkar, Artur S. d'Avila Garcez, "Accountability in AI: From Principles to Industry-specific Accreditation", Cornell University, 8 Oct 2021.

[85] Dakuo Wang, Xiaojuan Ma, April Yi Wang, "Human-Centered AI for Data Science: A Systematic Approach", Cornell University, 3 Oct 2021.

[86] Bob Suh, "5 Rules to Manage AI's Unintended Consequences", Harward Business Review, May 21, 2021.

[87] Ayling, J., Chapman, A. Putting, "AI ethics to work: are the tools fit for purpose?", AI Ethics 2, 405–429 (2022).

4 OUTCOME BASED EDUCATION (OBE) AND JOB MARKET

There is a growing concern about the preparedness of universities to fulfill the job market needs in the face of rapidly advancing AI technology. According to the World Economic Forum, 6 in 10 workers will require training before 2027.

Erik Brynjolfsson, Professor at Stanford's Institute for Human-Centered Artificial Intelligence, explains how AI can be harnessed to reduce the skills gap. The World Economic Forum's Future of Jobs Report 2023 says that 60% of workers will require additional training by 2027, with the biggest priority being **analytical thinking**. "AI is helping to identify skills gaps and future jobs. An expert explains how"[88]

Outcome-based education (OBE) is one approach that has been proposed as a response to this problem. Advances in AI could transform education systems and make them more equitable – freeing up teachers' time so they could focus on social emotional learning. UNESCO has unveiled a new **AI roadmap for classrooms**, calling out to implement its recommendations on the ethics of AI to avoid its misuse. "UNESCO unveils new AI roadmap for classrooms"[89]

There is an ongoing discussion about the preparedness of universities to meet the job market needs in light of rapidly advancing AI technology. OBE is one approach that has been proposed as a response to this problem, and there are ongoing efforts by organizations such as UNESCO to develop guidelines and roadmaps for the ethical and effective use of AIED.

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[88] Kate Whiting, "AI is helping to identify skills gaps and future jobs. An expert explains how", WEF, May 1, 2023.

[89] UNESCO News, "UNESCO unveils new AI roadmap for classrooms", 26 May 2023.

4.1 PEDAGOGICAL ASPECT OF OBE

Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). It is an efficient learning method that focuses on results rather than learning processes.

Any element of the classroom such as curriculum, teaching methods, classroom activities, and assessments, are designed to achieve the specified and desired outcomes.

- "Importance of Outcome Based Education (OBE) to Advance Educational Quality and enhance Global Mobility"[90]
- "Outcome-based Education: An Outline"[91]

By the end of the educational experience, each student should have achieved the goal. "Outcome-based education"[92]

Outcome based methods have been popularly adopted in worldwide education systems at multiple levels. Its first emergence was around the end of the 20th century in Australia and South Africa, then expanded to many developed nations and regions such as the United States, Hongkong, and European Union in the next decade, and later around the world. Compared to Traditional Education, Outcome Based Education focuses on practical skills, competencies, and real-world applications, tends to engage students more actively in their learning process, promotes critical thinking and problem-solving skills, and is inherently flexible and adaptable to changes in industries and societal needs. "Outcome Based Education | A Complete Guide (2023)"[93]

In today's rapidly evolving job market, the importance of OBE becomes an imperative for any educational institution, public or private, from elementary schools to university levels.

The Government of Kosova has undertaken several actions to stimulate pupils and students to orient themselves towards professions that are attractive and highly demanded in the labor market (Professions in the fields of STEM, ITC, etc., although the arts, i.e. STEAM, should also be included) and these initiatives should be welcomed. However, the reaction of our universities is very inert and there is a lack of systemic and legislative actions to seriously address this problem in Kosovar education.

Here are some key reasons why OBE is crucial for meeting the needs of the job market:

- **Alignment with Industry Requirements:** OBE places a strong emphasis on aligning educational outcomes with the requirements of employers. This approach ensures that graduates possess the specific skills and knowledge needed to excel in their chosen fields. As industries evolve and new technologies emerge, OBE allows educational institutions to adapt their programs quickly to meet ever changing demands of the job market.

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[90] R.Nakkeeran, R.Babu, R.Manimaran, P.Gnanasivam, "Importance of Outcome Based Education (OBE) to Advance Educational Quality and enhance Global Mobility", International Journal of Pure and Applied Mathematics, Volume 119, No. 17 2018.

[91] Rao, N. J., "Outcome-based Education: An Outline", Sage Journals, January 7, 2020.

[92] Wikipedia, "Outcome-based education"

[93] Astrid Tran, "Outcome Based Education | A Complete Guide (2023)", AhaSlides, 30 Aug 2023.

- **Enhanced Employability:** OBE promotes the development of practical skills and competencies that are directly applicable to real-world job scenarios. Graduates who have undergone OBE are better prepared to enter the workforce, as they have acquired the skills, problem-solving abilities, and critical thinking capacity necessary for success in a competitive job market.
- **Measurable Learning Outcomes:** One of the core principles of OBE is the establishment of clear and measurable learning outcomes. This not only provides students with a clear understanding of what is expected of them but also allows educators to assess their progress accurately. This data-driven approach aids in identifying areas where students may need additional support and ensures that graduates meet predefined standards of proficiency.
- **Continuous Improvement:** OBE encourages educational institutions to continuously evaluate and improve their programs based on feedback from employers and the performance of their graduates. This iterative process ensures that educational offerings remain relevant and up-to-date, ultimately leading to a better match between what students learn and what the job market demands.
- **Adaptability and Lifelong Learning:** The job market is characterized by constant change, with new industries, roles, and technologies emerging regularly. OBE instills in students the value of adaptability and lifelong learning. Graduates are equipped with the ability to quickly acquire new skills and knowledge, enabling them to stay competitive throughout their careers.
- **Global Competitiveness:** In an increasingly globalized world, graduates need to be competitive not only in their local job markets but also on an international scale. OBE promotes the development of globally relevant skills and competencies, making graduates more attractive to employers both at home and abroad.
- **Efficient Resource Allocation:** By focusing on outcomes, OBE helps educational institutions allocate resources more efficiently. Institutions can prioritize investments in areas that directly contribute to student success and employability, leading to a more cost-effective and sustainable education system.

In conclusion, Outcome Based Education is an essential approach for meeting the evolving needs of the job market. It ensures that graduates are well-prepared, adaptable, and equipped with the skills and knowledge required to excel in their careers. OBE's emphasis on measurable outcomes, alignment with industry requirements, and a commitment to continuous improvement makes it a powerful tool for both educators and students in today's competitive job market.

4.2 UNIVERSITIES - THE KEY TO OBE

To fully embrace Outcome Based Education (OBE), universities need to rethink and fundamentally change their roles and approaches. Here are some key aspects that highlight the necessary transformations:

- **Shift from Traditional to Outcome-Centric Curriculum:** Universities must transition from a traditional, content-driven curriculum to one that is centered on clear and measurable learning outcomes. This shift requires defining specific skills, competencies, and knowledge that students are expected to gain by the end of their programs, and then designing syllabuses, assessments, and teaching methods that facilitate the achievement of these outcomes.
- **Emphasis on Active Learning:** OBE places a strong emphasis on active learning methods, where students are actively engaged in the learning process rather than being passive recipients of information. Universities need to adopt innovative teaching techniques, such as problem-based learning, collaborative projects, and experiential learning, to promote deeper understanding and skill development among students.
- **Continuous Assessment and Feedback:** OBE relies on continuous assessment and feedback mechanisms to track students' progress toward achieving desired outcomes. Universities should implement regular formative assessments, provide timely feedback to students, and use this data to adapt instruction and support to address individual learning needs.
- **Faculty Development:** Faculty members play a pivotal role in implementing OBE effectively. Universities should invest in faculty development programs that help educators’ transition to outcome-focused teaching methods, assessment strategies, and syllabus design. This may involve retraining, providing resources, and fostering a culture of innovation and collaboration among teaching staff.
- **Flexible Program Structures:** OBE necessitates flexible program structures that allow students to customize their education based on their interests and career goals. Universities should offer modular courses, interdisciplinary options, and opportunities for students to engage in internships, co-op programs, or industry projects to gain practical experience.
- **Collaboration with industries:** Collaboration with industry becomes essential in OBE. Universities need to build strong relationships with employers to ensure learning outcomes match industry needs. Industry input should be used to design syllabi and internships or co-operative education programs that can be offered to students to create real-world experiences that await them after graduation.
- **Outcome Measurement and Data Analytics:** Universities should invest in data analytics and measurement tools to track the success of OBE initiatives. This involves collecting data on student performance, employment outcomes, and feedback from employers to continually assess and refine educational programs.
- **Quality Assurance and Accreditation:** Accreditation bodies and quality assurance agencies may need to adapt their evaluation criteria to align with OBE principles. Universities should work closely with these organizations to ensure that OBE initiatives are recognized and rewarded.
- **Student-Centered Support Services:** Universities should enhance support services to help students achieve their learning outcomes. This includes academic advising, career counseling, tutoring, and mental health support to ensure that students have the resources they need to succeed.

- **Cultural Shift:** Implementing OBE often requires a cultural shift within universities. Administrators, faculty, and staff need to buy into the philosophy of OBE and work collaboratively to drive meaningful change.

In conclusion, embracing Outcome Based Education requires a profound transformation of universities' roles, structures, and approaches to teaching and learning. This shift is essential to prepare students for the dynamic and demanding job market by ensuring they acquire the skills and competencies that employers' value most. It also aligns higher education more closely with the evolving needs of society and industry.

Outcome-Based Education can play a crucial role in preventing and reversing student emigration from Kosova by providing relevant, high-quality education that meets the needs of students and the local job market. It can empower students to see opportunities for personal and professional growth within Kosova, reducing the incentive to emigrate in search of better educational or career prospects elsewhere.

4.3 LET'S LEARN FROM THE ARIZONA STATE UNIVERSITY (ASU) EXAMPLE

Led by a visionary president Michael Crow, Arizona State University (ASU), is well known world wide for its innovative approach to education. "U.S. News & World Report ranking reflects a history of creative reimagining at the university"[94]

His quote that appears at the "Office of President" link of ASU portal: **"Learning is for everyone. If we can help universities to produce more master learners dedicated to the breadth and betterment of our society and our democracy, we will have had a major impact on the outcome of humanity."**, is the powerful enlightening message about the role of university in human society.

This University has indeed embraced Outcome Based Education (OBE) as part of its commitment to providing a forward-thinking and student-centered learning experience. Here are some ways in which ASU has incorporated OBE principles into its educational model:

- **Clearly Defined Learning Outcomes:** ASU has articulated clear and specific learning outcomes for its programs and courses. These outcomes are designed to reflect the knowledge, skills, and competencies that students should gain by the end of their academic journey. This transparency helps students understand what is expected of them and guides instructors in their teaching.
- **Flexible and Customizable Programs:** ASU offers a range of flexible program structures that allow students to tailor their education to their individual goals. Through ASU's design-your-own-degree program, students can choose courses that align with their desired learning outcomes and career aspirations.
- **Active Learning Pedagogy:** ASU promotes active learning by incorporating innovative teaching methods that encourage student engagement. This includes **flipped classrooms**[95], group projects, and experiential learning opportunities, all of which facilitate the development of practical skills and critical thinking.

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[94] ASU News, "U.S. News & World Report ranking reflects a history of creative reimagining at the university", September 12, 2021.

[95] A flipped classroom is an instructional approach in education where traditional teaching methods are reversed. In a traditional classroom, students typically learn new content through lectures and classwork is done as homework. In a flipped classroom, this sequence is "flipped." Students first engage with new content outside of class, often through video lectures or reading assignments, usually provided online. Then, in the classroom, they focus on active learning activities such as discussions, problem-solving, group projects, and direct interaction with the teacher to reinforce and apply what they've learned.

The flipped classroom model aims to make the most of in-class time for interactive and collaborative learning, allowing students to clarify concepts, ask questions, and work on more challenging aspects of the subject matter with the guidance of the teacher. This approach can promote greater engagement and deeper understanding of the material as students are actively involved in the learning process during class, rather than passively listening to lectures.

- **Adaptive Learning Technology:** ASU has invested in adaptive learning technologies that personalize the learning experience for students. These platforms use data and analytics to identify areas where students may be struggling and provide targeted resources and feedback to help them achieve their desired outcomes.
- **Competency-Based Education (CBE):** ASU has introduced competency-based education programs that allow students to progress at their own pace, demonstrating mastery of specific competencies rather than completing fixed-time courses. This aligns well with OBE's focus on measurable outcomes.
- **Collaboration with Industry:** ASU has established strong partnerships with industry leaders, ensuring that its programs are aligned with the current needs of the job market. This collaboration helps in defining relevant learning outcomes and providing opportunities for internships, research projects, and career placements.
- **Assessment and Data-Driven Decision-Making:** ASU uses data analytics to continuously assess and improve its educational offerings. Regular assessment of student performance and feedback from employers allows the university to refine its programs and better align them with the desired outcomes.
- **Support Services for Student Success:** ASU offers comprehensive support services to help students achieve their learning objectives. These include academic advising, career counseling, tutoring, and mental health resources to ensure that students have the support they need to succeed.
- **Commitment to Innovation:** ASU is consistently been ranked as the top university in the world for innovation. "ASU ranked No. 1 in innovation for 9th straight year"[96]
  ASU's recognition as the leader in this category by organizations such as the U.S. News & World Report's Best Colleges and Times Higher Education World University Rankings further solidifies its reputation for being at the forefront of innovative education and research practices. This prestigious ranking is a testament to the university's unwavering commitment to pioneering new approaches to learning, research, and problem-solving, making it a beacon for innovative thinking on a global scale.
- **Global Perspective:** ASU promotes a global perspective in its education by encouraging students to engage with diverse perspectives and cultures. This aligns with the need for graduates to be globally competent in an interconnected world.

In summary, ASU's embrace of Outcome Based Education is evident through its commitment to clear learning outcomes, active learning pedagogy, technology integration, collaboration with industry, and data-driven decision-making. ASU's innovative spirit extends to its approach to education, ensuring that students are well-prepared with the skills and competencies necessary for success in a rapidly changing world. This approach has contributed to ASU's reputation as one of the world's most innovative universities.

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[96] ASU News, "ASU ranked No. 1 in innovation for 9th straight year", September 17, 2023.

5 DILEMMAS ABOUT AIED

5.1 OPPORTUNITIES AND CHALLENGES OF AIED?

The article, "What Challenges In Education Can AI Solve Today?"[97], by Dmitry Baraishuk of Forbes, discusses how AI is becoming a disruptive factor in the educational area, with the **AIED market forecasted to grow by 45.12% annually** and reach $10.38 billion by 2026. E-learning makes education available anytime and anywhere, which has become crucial in the pandemic and remote work era.

AI boosts e-learning to a new level by addressing challenges that are not obvious at first glance:

- One of the challenges that AI can help solve is **filling skill gaps** by integrating, upskilling, and reskilling. Studies show that 9 in 10 executives recognize or expect staff skill gaps over the next five years, and less than half of them know how to overcome this challenge. An **AI-driven individual career path builder** can help acquire the necessary skills through a Learning Experience Platform (LXP). AI algorithms analyze an individual's current skill set, match the skills against the job requirements, emphasize the missing ones and advise the appropriate courses to fill in these skills gaps.
- Another challenge that AI can help solve is **matching the right talent to the right roles** on a scale. Corporations, training companies, and education tech startups are leveraging AI-based tools for workforce skills assessments that help match the right talent to the right roles on a scale.

However, there are a few important issues of incorporating AIED that need to be addressed as well:

- **Limiting human interaction and social skills development**: The challenge of losing the human touch and the social benefits of education when AI takes over some of the tasks and roles of teachers and students. "AIED: The 14 Uses and 8 Cons of Artificial Intelligence in Education"[98]
- **Increasing the costs and technical requirements**: The challenge of ensuring the availability, affordability, and quality of the resources and skills needed to implement and maintain AIED, especially in low-resource settings.
- **Making the educational process vulnerable to cyber-attacks, system failures, and compatibility issues**: The challenge of protecting the privacy, security, and reliability of the data, systems, and activities involved in AI-enabled education, and avoiding potential disruptions and conflicts.
- **Changing the roles of teachers and students and raising ethical and social concerns**: The challenge of redefining the expectations, responsibilities, and relationships of teachers and students in the context of AI, and addressing the ethical and social implications of AIED, such as fairness, transparency, accountability, and human dignity.

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[97] Dmitry Baraishuk, "What Challenges In Education Can AI Solve Today?", Forbes Technology Council, Dec 14, 2021.

[98] Arslan H., "AIED: The 14 Uses and 8 Cons of Artificial Intelligence in Education", AI Munch, February 22, 2023.

- **Reinforcing biases and perpetuating inequalities**: The challenge of preventing or mitigating the negative effects of AI on the diversity, inclusion, and equity of education, such as discrimination, marginalization, and polarization.

In conclusion, the use of AIED presents both opportunities and challenges. While AI can help fill skill gaps, match talent to roles, and make education more accessible, it also raises concerns about limiting human interaction, increasing costs and technical requirements, making the educational process vulnerable to cyber-attacks and system failures, changing the roles of teachers and students, and reinforcing biases and perpetuating inequalities. It is important to carefully consider these challenges and address them in a responsible and ethical manner to ensure that the benefits of AIED are maximized while minimizing its potential negative impacts.

5.2 RISKS OF AIED

While AI has the potential to address some of the biggest challenges in education today, innovate teaching and learning practices, and accelerate progress towards UN Sustainable Development Goals (SDG-4, in Education), rapid technological developments inevitably bring multiple risks and challenges, which have so far outpaced policy debates and regulatory frameworks.

- "The challenges and opportunities of Artificial Intelligence in education"[99]
- "Artificial Intelligence in education"[100]

UNESCO, Working paper: "Artificial intelligence in education: challenges and opportunities for sustainable development"[101], discusses the risks associated with the implementation of AIED that include:

- **Inclusion and equity:** The least developed countries are at risk of suffering new technological, economic, and social divides with the development of AI. Some main obstacles such as basic technological infrastructure must be faced to establish the basic conditions for implementing new strategies that take advantage of AI to improve learning.
- **Teacher preparation:** Teachers must learn new digital skills to use AI in a pedagogical and meaningful way, and AI developers must learn how teachers work and create solutions that are sustainable in real-life environments.
- **Data quality:** If the world is headed towards the datafication of education, the quality of data should be the main concern. It’s essential to develop state capabilities to improve data collection and systematization.

To address these risks, several measures can be taken:

- **Developing a comprehensive view of public policy on AI for sustainable development:** The complexity of the technological conditions needed to advance in this field requires the alignment of multiple factors and institutions. Public policies have to work in partnership at international and national levels to create an ecosystem of AI that serves sustainable development.
- **Ensuring inclusion and equity for AIED:** UNESCO is committed to supporting Member States to harness the potential of AI technologies for achieving the "Education 2030 Agenda"[102] while ensuring that its application in educational contexts is guided by the core principles of inclusion and equity.

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[99] UNESCO, "The challenges and opportunities of Artificial Intelligence in education", Last update:20 April 2023.

[100] UNESCO, "Artificial Intelligence in education"

[101] UNESCO, Pedró, Francesc; Subosa, Miguel; Rivas, Axel; Valverde, Paula, "Artificial intelligence in education: challenges and opportunities for sustainable development", 2019.

[102] UNESCO, "Education 2030: Incheon Declaration and Framework for Action for the implementation of Sustainable Development Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all", 2016.

Overall, it’s important to approach the implementation of AIED with caution, considering both the opportunities and risks associated with this rapidly growing field. By taking proactive steps to address these risks, we can ensure that AI is used responsibly and effectively in education.

6 THE STRATEGY FOR AIED IMPLEMENTATION IN KOSOVA

6.1 GENERAL CONTEXT

AI has emerged as a pivotal force in our ever-evolving technological landscape, promising to revolutionize the way we address existential problems, preserve human dignity, nurture peace, harmonize with nature, and cultivate healthy, empathic, and compassionate relationships. As AI continues to advance, its potential to reshape our world for the better becomes increasingly evident. Let as contemplate and explore how AI is contributing to these essential aspects of human existence.

AI and Existential Problems: Existential problems such as climate change, pandemics, and resource scarcity pose profound threats to humanity's future. AI empowers us to confront and mitigate these challenges in several ways:

- **Climate Modeling:** AI-driven climate models enhance our understanding of climate change, helping us predict its impacts more accurately and develop effective mitigation strategies.
- **Disease Detection:** AI can analyze vast datasets to detect outbreaks of diseases, enabling rapid response and containment, as seen during the COVID-19 pandemic.
- **Resource Management:** AI optimizes resource allocation, reducing waste and ensuring equitable access to essential resources like food, water, and energy.

AI and Human Dignity: Human dignity is inherently tied to individual rights, autonomy, and the elimination of discrimination. AI plays a pivotal role in safeguarding and promoting human dignity:

- **Healthcare Advancements:** AI-driven healthcare innovations improve diagnostics, treatment, and personalized medicine, enhancing individuals' health and well-being.
- **Fairness and Bias Mitigation:** AI tools can be designed to mitigate bias in decision-making processes, promoting fairness in areas such as criminal justice and hiring.
- **Accessibility:** AI-driven accessibility solutions empower individuals with disabilities, fostering inclusivity and ensuring equal opportunities.

AI and Peace in the World: AI has the potential to transform conflict resolution, diplomacy, and international relations, thus contributing to global peace and harmony:

- **Conflict Prediction:** AI algorithms can analyze geopolitical data to predict conflicts and facilitate early interventions, preventing violence and promoting peaceful resolutions.
- **Language Translation:** AI-powered language translation tools promote cross-cultural understanding, bridging communication gaps and fostering diplomacy.
- **Disaster Response:** AI assists in efficient disaster response by quickly assessing and coordinating resources during natural disasters and humanitarian crises.

AI and Harmony with Nature: To achieve sustainability and coexist harmoniously with the natural world, AI offers innovative solutions:

- **Conservation:** AI-powered monitoring systems track and protect endangered species, combat poaching, and support conservation efforts.
- **Renewable Energy:** AI optimizes the generation and distribution of renewable energy, reducing reliance on fossil fuels and mitigating environmental damage.
- **Sustainable Agriculture:** AI helps farmers improve crop yields while minimizing environmental impact through precision agriculture techniques.

AI and Empathy, Compassion, and Healthy Relationships: While AI is often seen as impersonal, it has the potential to enhance human relationships and promote empathy and compassion:

- **Mental Health Support:** AI-driven mental health applications offer accessible support and intervention, reducing the stigma associated with seeking help.
- **Virtual Companions:** AI-powered chatbots and virtual companions provide companionship and support, especially for the elderly and those facing social isolation.
- **Personalized Education:** AI-driven educational tools adapt to individual learning needs, fostering a sense of competence and reducing educational disparities.

AI represents a profound technological evolution that holds immense promise in addressing existential problems, preserving human dignity, nurturing peace and harmony, and building healthy, empathic, and compassionate relationships among people. To fully harness its potential, it is essential to develop AI responsibly, guided by ethical principles, and in collaboration with diverse stakeholders. In doing so, we can steer AI towards being a powerful force for positive change in our world. As we continue to embrace and adapt to AI, we must remain committed to the betterment of humanity and the planet we call home.

6.2 INTERNATIONAL CONTEXT

AI stands as a transformative force in promoting mutual respect and cooperation between nations while preserving cultural values and traditions.

AI can serve as a bridge between nations, facilitating cultural exchange, mutual understanding, and cooperation while addressing pressing global challenges in various ways:

- **AI and Cultural Preservation:** While AI facilitates cultural exchange, it also plays a vital role in preserving cultural values and traditions:
    - **Digital Archives:** AI can help digitize and catalog cultural artifacts, documents, and languages, preserving them for future generations.
    - **Heritage Restoration:** AI assists in the restoration and maintenance of historical sites and artifacts, ensuring that cultural heritage is conserved.
    - **Customized Education:** AI-driven educational platforms can provide tailored content that incorporates cultural knowledge, helping to pass down traditions to younger generations.
- **AI and Cultural Exchange:** Cultural exchange has the potential to bridge the gaps between nations, fostering mutual respect and cooperation. AI can facilitate this exchange in various ways:
    - **Language and Translation:** AI-driven translation services break down language barriers, enabling people from different cultures to communicate more effectively. This promotes cultural understanding and cooperation in fields such as diplomacy, trade, and academia.
    - **Art and Media:** AI algorithms can recommend music, films, literature, and art from different cultures based on individual preferences, encouraging people to explore and appreciate the cultural richness of other nations.
    - **Virtual Reality (VR):** AI-powered VR experiences can immerse individuals in the customs, traditions, and daily life of other cultures, promoting empathy and appreciation for diversity.
- **AI as a Promoter of Mutual Respect and Cooperation:** AI serves as a neutral platform that can foster mutual respect and cooperation between nations:
    - **Diplomacy and Conflict Resolution:** AI can assist in diplomacy by providing data-driven insights and unbiased analysis, facilitating peaceful negotiations and conflict resolution.
    - **Trade and Economics:** AI-driven trade models can identify opportunities for mutually beneficial economic cooperation, leading to enhanced international trade relations.
    - **Environmental Stewardship:** AI can aid in international efforts to address climate change and environmental challenges by providing data-driven solutions and monitoring global progress.
- **Differences Between Nations as Cooperation Enablers:** AI recognizes and respects the unique attributes of different nations and leverages these differences for cooperation:
    - **Cultural Diplomacy:** AI can tailor diplomatic efforts to respect cultural nuances, fostering trust and cooperation between nations.
    - **Cross-Cultural Innovation:** Differences in perspectives and approaches between nations can be harnessed to drive innovation and collaborative problem-solving in various fields.

   - **International Cooperation Platforms:** AI-powered platforms can facilitate international collaboration in research, healthcare, and disaster response, capitalizing on diverse expertise and resources.

AI is not only a technological marvel but also a powerful catalyst for promoting mutual respect, cultural exchange, and cooperation between nations. By breaking down language barriers, preserving cultural heritage, and providing neutral platforms for diplomacy and international collaboration, AI paves the way for a more interconnected and harmonious world.

6.3 KOSOVA SOCIETY CONTEXT

AIED can be an enabler to combat negative phenomena in modern Kosovar society As in many other societies worldwide, negative phenomena such as dishonest behavior, plagiarism, corruption, non-ethical conduct, hedonism, sexism, and homophobia, pose significant challenges. To address these issues and foster a more inclusive and ethical society, the integration of Artificial Intelligence in education can play a pivotal role.

In the interview for Urban FM conducted by Mentor Dida, the Kosovar catholic priest Dom Lush Gjergji, PhD in Psychology, humanist, polyglot, the world renowned biographer of Mother Theresa, translated in over 33 languages, makes a thought-provoking statement: "The world today is ruled by "dictators" which reside in our inner self: materialism, consumerism, hedonism, relativism and practical atheism."

What can AIED contribute to conquer and release us of these "dictators"? The answer to this question is not simple, but this technology, if well conceptualized and implemented carefully and consistent with ethical principles and values of humanism, may become a catalyst of emancipation and positive change in human behavior in the future.

By providing students with a comprehensive education that includes both technical and ethical training, AI can help create a generation of individuals who are better equipped to navigate the complexities of the modern world:

- **Fostering Ethical Behavior:** AI can be utilized in education to instill ethical values and behavior from an early age:
    - **Ethics Education:** AI-powered educational modules can include ethics and moral reasoning components, encouraging students to reflect on the consequences of their actions and make more ethical decisions.
    - **Plagiarism Detection:** AI-based plagiarism detection tools can be integrated into the educational system, discouraging dishonesty by identifying and penalizing academic misconduct.
- **Encouraging Critical Thinking and Independent Research:** AI can empower students to engage in critical thinking and independent research:
    - **AI Tutors:** AI-powered virtual tutors can assist students in researching topics, helping them develop research skills and reducing the temptation to plagiarize.
    - **Personalized Learning:** AI can tailor educational content to individual learning styles, encouraging students to think critically and develop their own opinions.
- **Promoting Inclusivity and Tolerance:** AI can facilitate understanding and tolerance among students, combating sexism and homophobia:
    - **Diversity and Inclusion Content:** AI-driven educational platforms can incorporate content that promotes diversity, gender equality, and LGBTQ+ rights, fostering a more inclusive environment.
    - **Anti-bullying Measures:** AI algorithms can detect and flag instances of bullying and discrimination, enabling timely interventions and support for affected students.
- **Enhancing Transparency and Accountability:** AI can help combat corruption and non-ethical conduct within educational institutions:

  - **Transparent Grading:** AI can provide transparency in grading, reducing opportunities for favoritism or bribery and ensuring fair evaluation.
  - **Anonymous Reporting:** AI-powered reporting systems allow students and staff to report unethical behavior anonymously, promoting accountability.
- **Addressing Hedonism and Promoting Well-being:** AI can also contribute to students' well-being, helping them make balanced choices:
  - **Supporting Mental Health:** AI chatbots and virtual counselors have the capacity to offer students assistance with their mental health concerns, fostering emotional well-being and decreasing the dependency on pleasure-seeking coping strategies.
  - **Balanced Curriculum:** AI can assist in designing a balanced curriculum that includes life skills, mindfulness, and stress management.

AI has the potential to serve as a transformative force in addressing the negative phenomena prevalent in modern Kosovar Albanian society. By integrating AI into education, we can nurture ethical behavior, critical thinking, inclusivity, and tolerance among students. This, in turn, can help combat dishonesty, corruption, non-ethical conduct, hedonism, sexism, and homophobia. However, the successful implementation of AIED requires a commitment from educational institutions, policymakers, and society at large to ensure that these technological advancements are used to create a more just, ethical, and inclusive society in Kosova and beyond.

6.4 KOSOVA EDUCATION TODAY

The education sector in Kosova has faced many challenges over the years. During the 1990s, the Serbian regime brutally repressed the Albanian population in Kosova, including in the field of education. Albanian-language schools were closed and education was allowed only in Serbian. This led to the establishment of a parallel education system by Albanians, where classes were held in private homes and other makeshift locations. "Lessons in Resistance: Kosova's parallel education system in the 1990s"[103]

After the liberation of Kosova from the Serbian occupation in 1999, the United Nations Interim Administration Mission in Kosova (UNMIK) took over the administration of the Kosova. During this period, education in Kosova was subject to reforms at all levels: from preschool education up to university level. These reforms aimed at adjusting the education in Kosova according to European and global contemporary standards. "Education in Kosova"[104]

Since the declaration of independence in 2008, the government institutions of Kosova have been responsible for the education sector. On 2011 the MASHT (Ministry of Education, Science and Technology) have approved new pre-university education curricula that calls for student centered and skills-based education, including utilization of digital education materials, but these basic concepts are not implemented up to date.

The latest documents related to education in Kosova explore critical aspects of the state of education in the country:

- MASHTI (Ministry of Education, Science, Technology and Innovation) announces the document "Education Strategy 2022-2026"[105] which is in accordance with the existing strategy of the Government and gives a good overview of the developments in this sector. However, the document does not provide a clear vision for the use of ICT in educational processes and also completely lacks a vision for the use of artificial intelligence in education (AIED).
- The document of the Academy of Sciences and Arts of Kosova (ASHAK): "Platform for the recovery of education in Kosova" (that exists in Albanian only): "PLATFORMË PËR RIMËKËMBJEN E ARSIMIT NË KOSOVË"[106], does not bring any details about AIED, although in general terms it mentions: "Digitalization of all learning processes", which implicitly can also mean the implementation of AIED.
- The other well documented and empirical study about the youth in Kosova, supported by Friedrich Ebert Stiftung Foundation titled: "YOUTH STUDY - KOSOVA 2018/2019"[107], emphasizes the dare situation in education sector in Kosova that leads to emigration of young Kosovars towards western countries.

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[103] Besa Shahini, "Lessons in Resistance: Kosova's parallel education system in the 1990s", Prishtina Insight, 14/10/2016.

[104] Wikipedia, "Education in Kosova", (ref. on Sep 6, 2023)

[105] MASHTI, "Education Strategy 2022-2026", Oct . 28, 2022.

[106] ASHAK, "PLATFORMË PËR RIMËKËMBJEN E ARSIMIT NË KOSOVË", 2021 (In Albanian).

[107] Oltion Rrumbullaku, in English "YOUTH STUDY - KOSOVA 2018/2019" and in Albanian, "STUDIMI PËR RININË – KOSOVË 2018/2019", FRIEDRICH EBERT STIFTUNG.

> The study reveals that the young generation of Kosova (born between 1989 to 2004), considered to be mostly similar to Generation Z or post-millennials, have a very specific and unique set of values, characteristics, and preferences. These young people have witnessed many social and economic transformations in their recent past. It is a generation that has been using the Internet since a young age and its members are generally comfortable with technology and interacting using social media.
> But on the other hand, the study shows that: "A sizable part of the focus-group participants admitted that they have witnessed bribery or nepotism in connection with education and employment, confirming that fair employment together with unemployment and corruption remain the main priority tasks that the government should tackle to ensure a better future for young people in Kosova."

Among a number of studies and reports of international agencies and organizations, the most comprehensive study about Kosova education system is "The Programme for International Student Assessment: An Overview"[108]. This assessment is important to Kosova policymaking because it provides valuable data and insights that can inform evidence-based decision-making, help identify areas for improvement, and enable Kosova to compete on a global scale by ensuring a high-quality education system.

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[108] OECD (2006), "The Programme for International Student Assessment: An Overview", PISA 2003 Technical Report, OECD Publishing, Paris.

6.5 DIGITALIZATION AND TECH INDUSTRY IN KOSOVA

During the last few years, a promising development have taken place in Kosova in terms of digitalization in various fields. The Government of Kosova's attention to the Information and Communications Technology (ICT) sector is worth mentioning, despite the lack of more systemic approach. Their initiatives to encourage young individuals to pursue careers in this field, as well as their efforts to foster collaboration with several of the largest United States ICT firms, are noteworthy.

A significant progress has been made in the **digitalization of services for citizens**, such as the fast-developing state platform eKosova, simplified taxation system, e-banking, commercial and other services, which, in addition to facilitating citizens, also serve to raise awareness of the importance and necessity of informatization of Kosova society.

In the article "The IT Industry in Kosova - Country Profile and Overview"[109], the author outlines that the **IT industry in Kosova** is one of the fastest-growing sectors in the country's economy, with a lot of potential for further growth. The country has a young and tech-savvy population, which provides a pool of talent for the industry. The tech sector of Kosova is a rapidly growing one with multiple international companies and local companies providing services to clients around the world. There is a growing pool of talent and most recently acquisitions have been going on, focused on tapping into the local talent to grow international companies and boost digital transformation competency.

A number of non-government organizations working in ICT sector, like:

- Kosova Association of Information and Communication Technology (STIKK),
- Innovation Centre Kosova (ICK), Open Data Kosova,
- Innovation & Training Park in Prizren (ITP),

and others, have contributed to advance the awareness for importance of ICT for Kosova society and they have already tackled the AI implications as well.

The Kosova Digital Economy (KODE) project has also pawed the way in improving access to better quality and high-speed broadband services in project areas. This project enabled the use of the fiber infrastructure of Kosova's Transmission, System, and Market Operator (KOSTT), and supported the design of innovative broadband pilots which favored open competition. As a result of these efforts, Kosova now has one of the highest numbers of high-speed internet subscriptions per household in Europe, outpacing leading EU countries according to data published by EUROSTAT (2021). This improved connectivity has brought a digital lifeline to remote locations where it was needed the most – schools, health centers, and homes.

The young ICT specialists in Kosova are well informed on importance of AI advanced ICT.

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[109] Dan Irascu, "The IT Industry in Kosova - Country Profile and Overview", TechBehemoths, Updated on: May 16, 2023.

In the story of UNDP-Kosova titled: "KOSOVA'S DIGITAL SKILLS PROGRAMME EMPOWERS YOUTH FOR FUTURE JOBS"[110] few participants, after completing the training commented:

- Viola Maksuti: "I find the digital transformation driven by AI fascinating and dynamic. AI has the potential to revolutionize industries, offering benefits such as automation, improved decision-making, and increased efficiency."
- Omer Islami: "I believe that by embracing digital transformation and AI with a balanced perspective and a commitment to ethical practices, we can harness their power to improve lives, drive innovation, and create a better future for all."
- Donika Jupaj: "By leveraging advanced data engineering techniques and tools, my goal is to derive precise and meaningful insights that can drive informed decision-making in the energy trading domain."
- Rron Daci: "AI plays a crucial role in analyzing vast amounts of data, uncovering patterns, and identifying trends."

In the same time, the ICT industry in Kosova have a promising perspective. In his article titled "Kosova: An Example Of How Young Professionals Can Transform The Tech Industry"[111], published by Forbes, Fatos Ameti, a former Forbes Councils Member and CEO at Sonnecto, a tech-driven company specialized in customer & software solutions, discusses how Kosova, the youngest country in Europe, has made significant progress in the past 20 years, particularly in the tech industry.

With an average age of 26, Kosova has the youngest population out of all European countries, where the average age is closer to 40. This youthful population gives Kosova a considerable advantage in the digital age. The article also discusses how the state of uncertainty created by economic and political flux has created urgency for the people of Kosova to create new quality jobs that ensure the youth's talents are put to good use.

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[110] UNDP Kosova*, "KOSOVA'S DIGITAL SKILLS PROGRAMME EMPOWERS YOUTH FOR FUTURE JOBS", Story by: Enis Mustafa, August 23, 2023.

[111] Fatos Ameti, "Kosova: An Example Of How Young Professionals Can Transform The Tech Industry", Forbes, Apr 18, 2022.

6.6 PISA 2018 - KOSOVA STUDENTS’ STRENGTHS AND WEAKNESSES

The summarized PISA 2018 report on Kosova: Education GPS, Kosova Profile[112], published by Education GPS, and OECD, "21st-Century Readers - Developing Literacy Skills in a Digital World"[113], gives an extensive set of scientifically based findings about the performance of Kosova 15 years old students compared to their peers in other PISA participating countries.

But, in the context of AIED the report does not provide any explicit information, hence I have presented below a narrow list of PISA findings on Kosova that I believe to be the most relevant for the subject of this work:

6.6.1 STRENGTHS:

- **School Climate (Co-operation):** Students in Kosova are highly cooperative, ranking 4th out of 75 participating countries and economies. This indicates a positive and collaborative atmosphere within schools.
- **Student Well-being:** Kosova has one of the highest levels of student life satisfaction (ranked 3rd out of 68), strong positive feelings (ranked 3rd out of 67), and a low proportion of students reporting feeling sad (ranked 64th out of 70). This suggests a supportive and happy environment for students.
- **Students' Engagement, Drive, and Self-beliefs:** Kosova's 15-year-old students exhibit strong self-belief in their ability to perform, especially in the face of adversity, ranking 9th out of 75. This indicates a positive attitude towards learning and overcoming challenges.
- **Students' Global Competence:** Kosova students show a high level of awareness of global issues (ranked 7th out of 62), perspective-taking (ranked 3rd out of 62), interest in learning about other cultures (ranked 3rd out of 60), and awareness of intercultural communication (ranked 6th out of 61). This reflects a global perspective and openness to diverse cultures.
- **Teachers' Practices:** Students in Kosova perceive their teachers as enthusiastic (ranked 2nd out of 73) and supportive (ranked 6th out of 72). This indicates a positive teacher-student relationship and teaching environment.

6.6.2 WEAKNESSES:

- **Students' Performance:** Kosova's students perform poorly in reading, mathematics, and science, with mean scores ranking among the lowest (71st, 72nd, and 72nd out of 74 and 75, respectively). Additionally, the percentage of low performers in all subjects is one of the highest, ranking 3rd out of 74. This suggests a need for improvement in academic achievement.
- **Students' Engagement, Drive, and Self-beliefs:** A significant percentage of students in Kosova believe that their intelligence is not something they can change very much (ranked 75th out of 76). The fixed mindset can hinder their motivation and willingness to learn.

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[112] PISA report 2018 - Education GPS, Kosova Profile.

[113] OECD, "21st-Century Readers - Developing Literacy Skills in a Digital World", Published on May 04, 2021.

- **Dynamic Navigation in Reading Assessment:** More than 75% of Kosova students showed no navigation in the PISA 2018 reading assessment, indicating limited interactive engagement with digital learning materials. Only 7% of Kosova students activated multiple-source navigation activities. This highlights a potential digital literacy gap.
- **Resources for Education:** Kosova faces a shortage of educational materials in schools, ranking 1st out of 76. This lack of resources can hinder effective teaching and learning.

In summary, while Kosova students demonstrate strengths in terms of a positive school climate, well-being, global competence, and positive teacher-student relationships, they face significant challenges related to academic performance, a fixed mindset, limited engagement with digital learning materials, and a shortage of educational resources. **Addressing these weaknesses will be crucial for the successful implementation of AI in Kosova's education system.**

6.7 DEVELOPING LONG-TERM AIED STRATEGY

AI has the potential to be a *leapfrog technology*[114] of the education sector in underdeveloped countries and especially for Kosova, due to the marked backwardness we have in our education. This technology, if implemented carefully, with appropriate investment and dedication, can bring the quality of our education closer to that of developed countries at an accelerated pace.

Technology-enhanced learning can help us keep up with demand and offer pathways for the existing workforce to gain new skills and reduce young generation emigration trends and brain drain from Kosova. AI-based learning tools developed in the past decade have incredible potential to personalize education, enhance college readiness and access, and improve educational outcomes. "How higher education can adapt to the future of work"[115].

These are the reasons that a long-term strategy for AIED is needed, with a focus on integrating AI technologies into the university syllabuses and education curriculum.

To successfully implement AI in the education system of Kosova, a long-term AIED strategy should be developed.

- "AI and education: Guidance for policy-makers"[116]
- "Artificial Intelligence in Education: Challenges and Opportunities for Sustainable Development"[117]

that includes several major milestones:

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[114] Leapfrog technology refers to the adoption and development of advanced or cutting-edge technology, often skipping over intermediate stages or older, less efficient technologies. This approach allows a country, industry, or organization to quickly catch up with or even surpass more technologically advanced counterparts.

The term is often used in the context of developing countries or regions that have the opportunity to skip traditional stages of technological development due to various factors, such as access to newer and more efficient technologies, rapid innovation, or favorable economic conditions. By leapfrogging, these entities can achieve rapid progress in areas like telecommunications, energy, healthcare, and education without going through the slow and costly process of adopting and then phasing out outdated technologies.

For example, in some developing countries, the widespread adoption of mobile phones and internet connectivity leapfrogged traditional landline telecommunication infrastructure, allowing these regions to quickly connect with the global digital economy.

Leapfrog technology can lead to significant economic and social benefits, as it enables quicker and more efficient development while minimizing the drawbacks of outdated technologies.

[115] WEF, "How higher education can adapt to the future of work", Jan 21, 2020.

[116] UNESCO: "AI and education: Guidance for policy-makers", 2021.

[117] UNESCO, "Artificial Intelligence in Education: Challenges and Opportunities for Sustainable Development", 7 March 2019, Last update:20 April 2023.

- **Developing a comprehensive plan for AI integration in the curriculum**, including identifying key areas where AI can have the greatest impact and setting specific goals and targets.
- **Providing training and support for teachers** to effectively integrate AI technologies into their teaching practice.
- **Investing in the necessary infrastructure,** such as high-speed internet and modern digital equipment, to support the use of AI in schools.
- **Establishing partnerships** with technology companies, universities, and other organizations to design original or adopt educational AI apps and support the development and implementation of AIED in entire education sector.
- **Regularly evaluating the progress and impact of AI integration,** and making necessary adjustments to ensure that the strategy remains effective and aligned with the needs of students and teachers.

In order to ensure successful, efficient and smooth implementation of AIED strategy, the following guiding principles and actions shell be considered:

- **Developing ethical and legal frameworks for the use of AIED** involves creating and enforcing standards and regulations for the ethical and responsible use of AIED, such as protecting the rights and interests of learners and teachers, ensuring the quality and reliability of AI solutions, and preventing and addressing potential harms and risks of AI, such as data breaches, algorithmic bias, or misuse of AI. This requires the collaboration and coordination of various stakeholders, such as policymakers, educators, researchers, industry partners, and civil society organizations, to establish common principles, guidelines, and best practices for design and use of AIED.
- **Promoting equitable and inclusive access to AIED** means that all learners and teachers should have the opportunity to benefit from AIED, regardless of their socio-economic status, gender, location, ethnicity, language, culture, or disability. It also requires the development and provision of AI solutions that are affordable, accessible, adaptable, and culturally relevant, and that address the specific needs and challenges of different groups of learners and teachers. This also requires the empowerment of girls and women and disadvantaged socio-economic groups to participate in the design, development, and use of AIED.
- **Enhancing teacher capacity and professional development for the use of AIED** involves improving the skills and competencies of teachers to effectively use AI in their teaching and learning practices, such as integrating AI into their pedagogy, curriculum, and assessment methods, using AI to enhance their communication and collaboration with learners and other educators, and using AI to support their own learning and professional development. It also requires the provision of training, resources, and support for teachers to learn about the potential and limitations of AIED, to explore and evaluate various AI solutions, and to collaborate with AI experts and researchers.
- **Fostering innovation and research on the use of AIED** involves encouraging the creation and testing of new and innovative AI solutions that address the needs and challenges of learners, teachers, and educational institutions, such as improving learning outcomes, enhancing learner engagement and motivation, supporting personalized and adaptive learning, optimizing educational management and administration, or facilitating lifelong learning. This also involves conducting research and evaluation on the impact and effectiveness of AI solutions in education, such as measuring their learning outcomes, assessing their usability and user satisfaction, or analyzing their ethical and social implications.

- **Engaging stakeholders and fostering dialogue on the use of AIED** is another crucially important task of involving various stakeholders in the design, implementation, and governance of AI solutions in education, such as learners, teachers, parents, policymakers, industry partners, civil society organizations, or other relevant actors. This task requires the creation of platforms and mechanisms for stakeholder engagement and dialogue on the use of AIED, such as consultations, workshops, forums, or networks. It also requires the promotion of awareness and understanding of AI among stakeholders, such as providing information, education, or communication materials on the benefits and challenges of AIED.

In conclusion, implementing a long-term strategy for AI integration in education can bring significant benefits to Kosova's education system. By following a structured approach and learning from successful examples around the world, Kosova can harness the power of AI to improve the quality of education and prepare its students for the future.

Given the existential importance that this technology has for the Albanian national education, it is of fundamental importance that this strategy be done in cooperation, full consensus and joint funding with the educational institutions of Kosova and Albania.

In this regard, the example for Kosova and Albania to follow is the Israel AI national program. The paper "Visions of innovation and politics: Israel's AI initiatives"[118] by Guy Paltieli, published in Discover Artificial Intelligence, examines the creation of Israel's national AI program. It reviews two documents that were published as part of this national effort and analyses their vision, objectives, recommendations, and ethical and regulatory frameworks.

The paper argues that Israel's national visions of innovation shape the outlook on the implementation of AI in society. However, it also shows how a specific and deeply-rooted ethos in Israeli culture made it choose a "national program" instead of a "national strategy". The reason for choosing such a course was to maintain agility and promote innovation.

This decision bears important implications regarding ethical and regulatory issues. The paper suggests that Israel needs to proactively maintain its leading technological position in a way that would also influence its ability to sustain itself as a country.

The author concludes by suggesting that a strategic effort is needed in Israel and argues that more stakeholders should be included within it, in order to form a concensual technological vision.

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[118] Paltieli, G., "Visions of innovation and politics: Israel's AI initiatives", Discover Artificial Intelligence 2, 8 (2022).

6.8 CHALLENGES OF IMPLEMENTATION OF AIED IN KOSOVA

The implementation of AIED, especially in undeveloped regions such as Kosova, faces several challenges. The UNESCO document "The challenges and opportunities of Artificial Intelligence in education"[119], outlines the following:

- **Developing a Comprehensive Public Policy on AI for Sustainable Development**
  The complexity of the technological conditions needed to advance in this field requires the alignment of multiple factors and institutions. Public policies have to work in partnership at international and national levels to create an ecosystem of AI that serves sustainable development. In undeveloped regions, including Kosova, the lack of a comprehensive public policy on AI can hinder its implementation in education.
- **Ensuring Inclusion and Equity for AIED**

  The least developed countries are at risk of suffering new technological, economic, and social divides with the development of AI. Basic technological infrastructure must be established to implement new strategies that take advantage of AI to improve learning. In regions like Kosova, ensuring inclusion and equity for AIED can be very challenging due to limited resources and infrastructure.

- **Preparing Teachers for an AI-Powered Education**

  Teachers must learn new digital skills to use AI in a pedagogical and meaningful way. Additionally, AI developers must understand how teachers work and create solutions that are sustainable in complex real-life environments. The lack of adequate training programs for teachers can pose a significant challenge in Kosova.

- **Developing Quality and Inclusive Data Systems**

  As the world heads towards the datafication of education, the quality of data should be the main concern. It's essential to develop state capabilities to improve data collection and systematization in all sectors including education. Developing quality and inclusive data systems is of utmost importance for Kosova, although it represents a big challenge due to limited resources.

- **Ensuring participation of Kosova in EU "Digital Education Action Plan 2021-2027"**

  Although Kosova is not the member state of EU, ensuring Kosova's participation in the EU's "Digital Education Action Plan (2021-2027) - European Education Area."[120] is possible and existentially important for several reasons:

  - **Quality of Education:** The plan sets out a common vision of high-quality, inclusive, and accessible digital education in Europe. It aims to support the adaptation of the education and training systems of EU Member States to the digital age. By participating in this plan, Kosova can enhance the quality of its education system.

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[119] UNESCO, "The challenges and opportunities of Artificial Intelligence in education", 7 March 2019

Last update:20 April 2023.

[120] European Commission, "Digital Education Action Plan (2021-2027) - European Education Area."

  - **Digital Skills:** The plan emphasizes the development of digital skills. As more than 57% of youth between 15 and 24 years in Kosova are unemployed, improving digital skills can increase their employability, especially in today's digital economy.
  - **Access to Resources:** Participation in the plan could provide Kosova with access to resources and support from other EU member states. This could be particularly beneficial for improving the country's digital infrastructure related to education.
  - **European Integration:** Participation in such EU-wide initiatives is a step towards greater integration with Europe. This could have broader benefits beyond education, including economic and political advantages.
  - **Addressing Disparities:** The education system in Kosova has been badly affected by historical and political events. The Digital Education Action Plan could help address educational disparities and ensure that all students have access to quality education.
  - **Future-Proof Education:** With rapid digitalization transforming many aspects of work and daily life, it's crucial for the education system to keep pace. The AIED could help Kosova's education system stay relevant and effective in the digital age.

- **Participation of Kosova with EU initiatives in digitalization and AIED:**

  Considering the desperate state of education in Kosova in terms of quality and lack of teaching materials at all levels of education, the cooperation and incorporation of the education system of Kosova within the "European Digital Education Content Framework"[121] is of utmost importance. Kosova as a small country does not have the necessary professional capacities for authoring of quality digital teaching materials for students and teachers. This fact has already been proven and is indisputable. Considerable financial resources are spent each year in Kosova on the publication of paper books of extremely poor quality, while the publication of digital materials is not even a topic of discussion at all.

In conclusion, AI offers excellent opportunities for improving education in Kosova, despite major challenges. Capturing them requires a determined commitment from all stakeholders, including the Kosova Government, educators, civil society, teachers, academia and Kosova ICT industry.

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[121] European Commission, "European Digital Education Content Framework", the part of Digital Education Action Plan 2021-2027 – Action 3.

7 ANNEXES

7.1 INTERNATIONAL AGENCIES PROMOTING AIED

After the launch of Open AI ChatGPT at the end of 2022, the integration of AIED systems is expected gain much more attention of governments all around the world. Just as I am writing this work, UNESCO is calling policymakers to action: **"As pupils in part of the world return to school after the summer break, UNESCO is calling on governments to implement appropriate regulations and teacher training, to ensure a human-centered approach to using Generative AIED."** "UNESCO: Governments must quickly regulate Generative AI in schools"[122]

The debate surrounding the implementation of AI in education systems globally reflects a complex interplay of factors that influence the hesitancy or reluctance of many countries to embrace this transformative technology. While some nations have enthusiastically adopted AIED, others remain cautious or have yet to fully consider its integration.

The varying pace of AI adoption in education systems globally can be attributed to a combination of technological, financial, cultural, regulatory, and ethical considerations. While some countries have embraced the potential of AI to enhance education, others continue to grapple with challenges that may delay or limit their willingness to embark on this transformative journey.

However, the top international agencies dealing with education and growing numbers of governments in the world, have already undertaken the significant efforts to foster implementation of AIED systems. The activities of some important world organizations are briefly given below:

UNESCO

The Beijing Concensus on AIED: "Beijing Consensus on Artificial Intelligence and Education"[123] is a document that was adopted during the International Conference on Artificial Intelligence and Education, held in Beijing from 16 – 18 May 2019. It is the first ever document to offer guidance and recommendations on how best to harness AI technologies for achieving the "Education 2030 Agenda"[102]

The Consensus affirms that the deployment of AI technologies in education should be purposed to enhance human capacities and to protect human rights for effective human-machine collaboration in life, learning and work, and for sustainable development. The Consensus states that the systematic integration of AIED has the potential to address some of the biggest challenges in education today, innovate teaching and learning practices, and ultimately accelerate the progress towards sustainable development:

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[122] UNESCO, "UNESCO: Governments must quickly regulate Generative AI in schools", Press release, 7 September 2023.

[123] UNESCO: "Beijing Consensus on Artificial Intelligence and Education", May 2019.

SDG 4 (The 2030 Agenda for Sustainable Development, Goal 4), "TRANSFORMING OUR WORLD: THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT"[124].

The UNESCO publication "AI and education: Guidance for policy-makers"[125] is a document aimed at fostering the readiness of education policy-makers in AI. It was developed within the framework of the Beijing Consensus and is part of UNESCO's portfolio for supporting digital learning policies.

The document provides guidance for policy-makers on how to harness the potential of AI technologies for achieving the "Education 2030 Agenda"[102] while ensuring that its application in educational contexts is guided by the core principles of inclusion and equity. UNESCO's mandate calls for a human-centered approach to AI, aiming to shift the conversation to include AI's role in addressing current inequalities regarding access to knowledge, research, and the diversity of cultural expressions, and to ensure that AI does not widen the technological divides within and between countries.

The UNESCO project "Artificial intelligence and the Futures of Learning"[126] builds on the Recommendation on the Ethics of AI adopted at the 41st session of the UNESCO General Conference in 2019 and follows up on the recommendations of the UNESCO global report "Reimagining our futures together: a new social contract for education"[127], launched in November 2021. The project is implemented within the framework of the Beijing Consensus on Artificial Intelligence and Education and against the backdrop of the UNESCO Strategy on technological innovation in education (2021-2025). It is led by the Unit for Technology and AIED under Future of Learning and Innovation Team of UNESCO's Education Sector.

The project consists of three independent but complementary strands: AI and the Future of Learning, Guidance for Generative AIED and research, and AI Competency Frameworks for teachers and students. The project is supported by the Tomorrow Advancing Life Education Group (TAL) of China, a long-term partner of UNESCO and one of the sponsors of the International Conference on Artificial Intelligence and Education.

The urgency of implementing AI in school curricula is highlighted by the rapid technological developments that have so far outpaced policy debates and regulatory frameworks. UNESCO has released "K-12 AI curricula: A mapping of government-endorsed AI curricula"[128], which revealed that only 11 countries have developed and endorsed K-12 AI curricula and only four other countries have AI curricula under development. The report calls for Member States to develop AI curricula for K-12 students, and to build stronger mechanisms to consider non-governmental AI curricula. It is important for countries to keep pace with tremendous technology advances in the field of AI in order to equip children with the competences needed to understand the power but also the ethical dilemmas related to this new technology. The goal is to create a framework that balances the benefits and risks associated with Generative AIEDal settings.

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[124] UNESCO, "TRANSFORMING OUR WORLD: THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT", Adopted on September 2015.

[125] UNESCO, "AI and education: Guidance for policy-makers", 2021.

[126] UNESCO, "Artificial intelligence and the Futures of Learning", the ongoing project.

[127] UNESCO, "Reimagining our futures together: a new social contract for education", November 2021.

[128] UNESCO, "K-12 AI curricula: A mapping of government-endorsed AI curricula", 2022.

In it's press release of September 7, 2023, "Governments must quickly regulate Generative AI in schools"[6], UNESCO emphasizes the urgent need for governments to establish regulations surrounding Generative AI's use in educational settings.

UNESCO has also published the first-ever "Guidance for generative AIED and research"[129], designed to address the disruptions caused by Generative AI technologies. This guidance sets out seven key steps for governments to regulate GenAI and establish policy frameworks for its ethical use in education and research, including through the adoption of global, regional or national data protection and privacy standards. **It also suggests an age limit of 13 for the use of AI tools in the classroom and calls for teacher training on this subject.**

WEF

The WEF-World Economic Forum, also sees the potential of AI to accelerate the long overdue transformation of education systems towards inclusive learning that will prepare young people to thrive and shape a better future. At the same time, they see huge opportunities for teachers to use these technologies to enhance their own teaching practice and professional experience.

"With the rapidly accelerating integration of artificial intelligence (AI) in our work, life, and classrooms, educators all over the world are re-evaluating the purpose of education in light of these outsized implications. At "Teach For All" and the "LEGO Foundation", we see the potential of AI to accelerate the long overdue transformation of education systems towards inclusive learning that will prepare young people to thrive and shape a better future. At the same time, we see huge opportunities for teachers to use these technologies to enhance their own teaching practice and professional experience." "How AI can accelerate students' holistic development and make teaching more fulfilling"[130]

The WEF published an article on AIED in collaboration with The Conversation titled "Can AI improve education? Here are 4 potential use cases"[131] which discusses four ways AI systems can be used to help students learn. These include differentiated instruction, intelligent textbooks, personalized learning, and real-time feedback.

UNICEF

The UNICEF - United Nations Children's Fund, has developed a "Policy guidance on AI for children"[132] to promote children's rights in government and private sector AI policies and practices, and to raise awareness of how AI systems can uphold or undermine these rights. **"Artificial Intelligence (AI) systems are fundamentally changing the world and affecting present and future generations of children. Children are already interacting with AI technologies in many different ways: they are**

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[129] UNESCO, "Guidance for generative AIED and research", 2023.

[130] WEF, "How AI can accelerate students' holistic development and make teaching more fulfilling", GROWTH2023 blog, May 1, 2023.

[131] WEF, "Can AI improve education? Here are 4 potential use cases", Apr 18, 2023.

[132] UNICEF, Virginia Dignum, Melanie Penagos, Klara Pigmans and Steven Vosloo, "Policy guidance on AI for children", November 2021.

embedded in toys, virtual assistants and video games, and are used to drive chatbots and adaptive learning software".

The policy guidance explores AI systems and considers the ways in which they impact children. Drawing on the "Convention on the Rights of the Child"[133], the guidance offers nine requirements for child-centered AI, including supporting children's development and well-being, ensuring inclusion of and for children, prioritizing fairness and non-discrimination for children, protecting children's data and privacy, ensuring safety for children, providing transparency, explainability, and accountability for children, empowering governments and businesses with knowledge of AI and children's rights, preparing children for present and future developments in AI, and creating an enabling environment.

OECD

The OECD - Organisation for Economic Co-operation and Development, works with over 100 countries and is a global policy forum that promotes policies to improve the economic and social well-being of people around the world. It provides a platform to compare policy experiences, seek answers to common problems, identify good practices, and coordinate domestic and international policies of its members.

OECD.AI is the OECD Artificial Intelligence Policy Observatory. It is a platform designed to share and shape public policies for responsible, trustworthy, and beneficial AI. The observatory combines resources from across the OECD and its partners from all stakeholder groups. It facilitates dialogue and provides multidisciplinary, evidence-based policy analysis and data on AI's areas of impact. It's a unique source of real-time information, analysis, and dialogue designed to shape and share AI policies across the globe.

The portal "Going Digital Toolkit" helps countries assess their state of digital development and formulate policies in response. Data exploration and visualization are key features of the Toolkit.

EUROPEAN UNION

The European Commission has been actively involved in promoting the integration of AIED systems. The European Commission has developed ethical guidelines on the use of AI and data in teaching and learning to help teachers and educators understand the potential that the applications of AI and data use can have in education and to raise awareness of the possible risks. The Commission will support related research and innovation activities through the Horizon Europe program and develop a training program for researchers and students on the ethical aspects of AI and data use.

The "Digital Education Action Plan (2021-2027)"[134], is a comprehensive plan that outlines several actions to be taken by the EU to promote digital education. Some of these actions include:

- Developing a structured dialogue with Member States on digital education and skills;

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[133] UNESCO, "Convention on the Rights of the Child".

[134] European Commission, "Digital Education Action Plan (2021-2027)".

- Proposing a Council recommendation on “blended learning”[135] approaches for high-quality and inclusive primary and secondary education;
- Developing a European Digital Education Content Framework;
- Supporting digital transformation plans for education and training institutions;
- Developing ethical guidelines on the use of AI and data in teaching and learning for educators;
- Fostering digital literacy and tackling disinformation through education and training;
- Updating the European Digital Competence Framework to include AI and data-related skills;
- Developing a European Digital Skills Certificate (EDSC);
- Improving the provision of digital skills in education and training;
- Collecting cross-national data on student digital skills;
- Supporting Digital Opportunity Traineeships;
- Promoting women’s participation in STEM, and
- Establishing a European Digital Education Hub.

AI Watch is the artificial intelligence website of the European Commission's Joint Research Center (JRC), which presents a comprehensive picture of what is happening in this field between the EU Member States, Norway and Switzerland. A comprehensive overview of the situation is presented in "National strategies on Artificial Intelligence - A European perspective"[136], which is the joint JRC-OECD report.

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[135] Blended learning, also known as hybrid learning, is an educational approach that combines traditional face-to-face classroom instruction with online learning activities. It seeks to leverage the strengths of both in-person and digital learning to create a more effective and flexible educational experience.

[136] JRC-OECD, "National strategies on Artificial Intelligence - A European perspective", 2021 EDITION.

7.2 AIED WORLDWIDE

AI in general and AIED is being implemented worldwide, with different approaches and dynamics. The implementation of this technology is easier in countries that have already reached a level of infrastructure and digital services in general.

The countries that have produced public AI policies include Australia, Austria, Belgium, Canada, China, Czechia, Denmark, Estonia, Finland, France, Germany, India, Italy, Japan, South Korea, Lithuania, Luxembourg, Malta, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Qatar, Russia, Serbia, Singapore, Spain, Sweden, UAE, UK, Uruguay and USA.

Below is the non-exhaustive list of worldwide examples of AI and AIED implementation policies and initiatives presented in alphabetical order.

AUSTRALIA

AI in Schools Report: The Department of Education commissioned a research report on Artificial Intelligence and Emerging Technologies in Schools from the University of Newcastle: "Artificial intelligence and emerging technologies (virtual, augmented and mixed reality) in schools: A research report."[2].

Parliamentary Inquiry: The House Standing Committee on Employment, Education and Training adopted an inquiry into the use of generative artificial intelligence in the Australian education system on 24 May 2023, "Inquiry into the use of generative artificial intelligence in the Australian education system".[137]

Public Hearing: The House of Representatives Standing Committee on Employment, Education and Training held its first public hearing for its inquiry into the use of generative artificial intelligence (AI) in the Australian education system, "Experts to discuss AI in Australian education".[138]

AUSTRIA

The Artificial Intelligence Mission Austria 2030 (AIM AT 2030)[139] is a strategy adopted by the Austrian Federal Government in 2021 to leverage AI opportunities and mitigate potential risks. The strategy focuses on enhancing digital skills, promoting AI in education and workforce, and implementing measures to stimulate interest in STEM topics among children and young adults.

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[137] Parliament of Australia, "Inquiry into the use of generative artificial intelligence in the Australian education system", 24 May 2023.

[138] Parliament of Australia, "Experts to discuss AI in Australian education" 5 September 2023.

[139] Government of Austria, Artificial Intelligence Mission Austria 2030 (AIM AT 2030)

CANADA

Embracing AI in Post-Secondary Education: The University of Waterloo has been exploring the use of AI technologies like OpenAI's ChatGPT in education. They are interested in how it can be used in the service of education and how it impacts sectors across the economy. They are also experimenting with these new technologies and forecasting their potential impacts on society. "Post-secondary sector must embrace emerging AI technology in education"[140]

"As for any concerns about so-called student cheating ChatGPT may enable, the author O'Gorman notes there are always straightforward ways to adapt assessments to foster a culture of academic integrity and engagement. One easy way is to have students complete coursework that involves the creation and evaluation of knowledge, rather than more rudimentary assessment of memorization or simple understanding."

AI for Skills Development: Canada is examining AI and the ways in which AI is expected to continue changing economies and labor markets. "Understanding the impact of artificial intelligence on skills development"[141]

AI in Curriculum Design: Canadian educational institutions are using AI to improve learning outcomes and support teachers in developing better educational practices. This includes automating assignment grading and designing curriculums. "The role of AI in education: use cases, challenges, and future"[142]

The author emphasizes: "The role of Artificial Intelligence in content creation is vital. With the help of AI, educators can create and curate engaging and innovative content for their students. With AI-powered content creation tools, educators can create visually appealing and interactive learning materials in 2D and 3D. This enhances the students' understanding of complex concepts and enables them to engage more effectively with the material."

CHINA

AI technologies are being implemented in China's education system in two key ways: firstly, through the creation of educational tools that require basic automation technology, such as test grading and homework correction, and secondly, through the introduction of adaptive learning systems – a form of AI-driven educational technology that responds to a student's interactions in real time and automatically tailors support to their individual needs. "The Future of the Classroom? China's experience of AI in education"[143]

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[140] Jon Parsons, "Post-secondary sector must embrace emerging AI technology in education", University of Waterloo News, January 30, 2023.

[141] UNESCO, "Understanding the impact of artificial intelligence on skills development", 2021.

[142] Niha Parmanandani, "The role of AI in education: use cases, challenges, and future", OpenXcell, 16 October 2023.

[143] NESTA, "The Future of the Classroom? China's experience of AI in education", 18 May, 2020.

One example of AI education in China is Squirrel AI. Squirrel AI education platform specializes in “intelligent adaptive education.” The company is putting money into AI scientists so that they can invest more research into the field. Squirrel AI uses an algorithm so that students received 70% of teaching suggestions from AI and the other 30% from human teachers. "HOW AI EDUCATION IN CHINA IS REDUCING INEQUALITIES"[144]

China wants to improve the Chinese educational system, making sure that education is no longer a luxury reserved for the wealthy but instead accessible by every Chinese. The objective of AI technologies in education is to understand what students struggle with and develop elaborate specialized content to reinforce their knowledge. "AI technology and the future of education in China"[145]

FINLAND

Finland has a comprehensive digital education strategy in place and has incorporated AI and personalized learning platforms into its educational system. The country's strong focus on teacher training and student-centered approaches has yielded positive results. Several research initiatives focused on AI may be found in the Helsinki University project: AI in Learning.

FRANCE

The French AI strategy, entitled “AI for Humanity”, was launched by the President of the French Republic on March 29, 2018. One of the main objectives of this strategy is to improve the AI education and training ecosystem in order to develop, retain, and attract world-class AI talent. This is part of an ambitious plan that includes achieving a best-in-class level of research for AI, disseminating AI to the economy and society through startups, public-private partnerships and data sharing, and establishing an ethical framework for AI. The French government has dedicated a public fund budget of 1.5 billion euros for five years (2018-2022) to support this strategy. "AI for Humanity"[146]

GERMANY

According to the news article: "Germany prepares its schools for the age of artificial intelligence."[147], the Bavarian State Ministry for Education and Cultural Affairs has launched the “AI@school” pilot project. Over the next five years, 15 schools are to experiment specifically with artificial intelligence in education. Schools and teachers will be able to freely explore the numerous application scenarios of AI in an educational context.

HONG KONG

Hong Kong has been integrating AI into its education system. Here are some of the initiatives:

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[144] The Borgen Project, "HOW AI EDUCATION IN CHINA IS REDUCING INEQUALITIES", SEPTEMBER 11, 2022.

[145] Alessadro Golombiewski Teixeira, "AI technology and the future of education in China", 09-Aug-2019.

[146] French Government, "AI for Humanity", THE FRENCH AI STRATEGY 2018-2022.

[147] Matthias Bastian, "Germany prepares its schools for the age of artificial intelligence", DECODER, Nov 9, 2022.

Microsoft Hong Kong's AI Education program: This program supports the city's K-12 educators in integrating Artificial Intelligence (AI) in their teaching curriculum, as well as offering consultation in transforming traditional classrooms to best match the needs of teaching new technologies. The program consists of three key initiatives, namely "Microsoft #AI4Good Schools, Microsoft AI Pilot Schools and Microsoft AI Innovation Lab", each of which is designed to provide different resources and supports to K-12 schools in Hong Kong to enhance AI teaching and learning experiences. "Getting Hong Kong's K-12 "Education Future Ready with Artificial Intelligence"[148]

The Chinese University of Hong Kong: The university has guidelines on the use of Artificial Intelligence Tools in Teaching, Learning and Assessments. It encourages teachers and students to explore and take advantage of the benefits of adopting appropriate AI tools to enhance their teaching and learning activities. "Use of Artificial Intelligence Tools in Teaching, Learning and Assessments - A Guide for Students"[149]

Challenges/Issues: However, there are challenges associated with the use of AIED. For instance, issues have emerged with detecting plagiarism as AI integration expands. This has led universities to modify policies and promote openness. "ARTIFICIAL INTELLIGENCE FINDS ITS PLACE IN HONG KONG'S EDUCATIONAL LANDSCAPE"[150]

INDIA

India is integrating AI in its education system through the New Education Policy (NEP) 2020, which highlights the importance of artificial intelligence and integrates AI education at all levels. The policy aims to align India's curriculum to the 21st century and prepare students for the AI economy by imparting necessary technical knowledge at all levels of education. School children will be exposed to crucial skills such as digital literacy, coding, and computational thinking from a young age through the teaching of contemporary subjects such as artificial intelligence and "design thinking"[151]. Further, topics such as artificial intelligence, 3-D machining, big data analysis, and machine learning will be integrated with undergraduate education to train industry-ready professionals.

The NEP also envisions the use of AI-powered solutions for the attainment of its goals of a multilingual as well as holistic education. The efforts of promoting multilingualism among school students will be interlocked with efforts to enhance Natural Language Processing capabilities for India's diverse languages. "How India is integrating AI in the New Education Policy"[152].

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[148] Microsoft Hong Kong, "Getting Hong Kong's K-12 Education Future Ready with Artificial Intelligence", January 26, 2022.

[149] THE CHINESE UNIVERSITY OF HONG KONG, "Use of Artificial Intelligence Tools in Teaching, Learning and Assessments - A Guide for Students", March 2023.

[150] Brenda Kanana, "ARTIFICIAL INTELLIGENCE FINDS ITS PLACE IN HONG KONG'S EDUCATIONAL LANDSCAPE", CRYPTOPOLITAN, September 4, 2023.

[151] Design thinking is a problem-solving and innovation methodology that emphasizes a human-centered approach to addressing complex issues and creating new solutions. It's a structured process used by designers, but it's increasingly applied across various fields, including business, education, and product development.

[152] Samiksha Mehra, "How India is integrating AI in the New Education Policy", INDIAai, Aug 03, 2020.

Many Indian EdTech companies are developing AI tools and digital education platforms. "AI impact on India: AIED is changing India's learning landscape"[153]

IRELAND

Ireland's first National Strategy on Artificial Intelligence (AI) 'AI-Here for Good', published in 2021, sets out how Ireland can be an international leader in using AI to benefit our economy and society, through a people-centred, ethical approach to its development, adoption and use. One of its objectives is to consider how AI can be incorporated into future policy for digital learning. It is important that the "Digital Strategy for Schools" considers the use of data and AI in the educational context. "AI - Here for Good A National Artificial IntelligenceStrategy for Ireland"[154]

ISRAEL

Israel is among the world leading countries in the field of Artificial Intelligence (AI) and AI in Education (AIED). Here are some key aspects:

AI Policies and Initiatives: A cross-governmental team was set up to devise recommendations for a policy plan to promote AI Research & Innovation (R&I) activities.

- The Israel National Cyber Directorate is responsible for defending Israel's national cyberspace and for establishing and advancing Israel's cyber power. "AI policies in Israel"[155].
- On October 30, 2022, the Israeli Ministry of Innovation Science and Technology released its "Principles of Policy, Regulation and Ethics in AI", "ISRAELI AI REGULATION AND POLICY WHITE PAPER: A FIRST GLANCE"[156] white paper for public consultation. This white paper sets forth policy, ethics, and regulatory policy recommendations.

AI in Education Initiatives: Israel's national AI program was created with a vision to shape the implementation of AI in society. The program focuses on agility and innovation. "Visions of innovation and politics: Israel's AI initiatives"[118] by Guy Paltieli.

AI Research: Israel is considered a leader in the commercialization of AI technology. However, the amount of basic AI research being done in the country is considered "not sufficient". "An Israeli perspective on artificial intelligence in 2023"[157]

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[153] Parul Saxena, "AI impact on India: AIED is changing India's learning landscape", INDIAai, Jan 10, 2022.

[154] Irish Government, "AI - Here for Good A National Artificial IntelligenceStrategy for Ireland"

[155] OECD.AI, "AI policies in Israel"

[156] Amir Cahane, "ISRAELI AI REGULATION AND POLICY WHITE PAPER: A FIRST GLANCE", RAILS - Robotics and AI Law Society Blog, Nov. 13, 2022.

[157] MAAYAN JAFFE-HOFFMAN, "An Israeli perspective on artificial intelligence in 2023", Jerusalem Post, JANUARY 15, 2023.

- A 2022 Stanford University study found that Israel was ranked among the top five countries for significant machine learning systems and concentration of AI skills.
- Israeli startups like Gong, AI21 Labs, Verbit, Run AI, Trigo, and Pinecone have become some of the country's top tech success stories. "As Israel goes to war, global AI industry faces impacts on several fronts"[158]

These initiatives and research efforts highlight Israel's commitment to advancing AI technology and integrating it into various sectors, including education.

ITALY

The Italian government has planned a public investment of EUR 2.5 billion in AI1. This is part of Italy's long-term vision for a sustainable development of AI, which includes improving AI education at all levels, fostering AI research and innovation, establishing an ethical regulatory framework for a sustainable and trustworthy AI, and more. This strategy is aimed at increasing the development and competitiveness of AI in Italy. "Italy AI Strategy Report"[159]

JAPAN

The Government of Japan's AI and AIED initiatives are very advanced and comprehensive:

AI Strategy 2022: The Japanese government's "AI Strategy 2022 (Overview)"[160] outlines the country's approach to AI, with a focus on realizing Society 5.0 and contributing to Sustainable Development Goals (SDGs). The strategy is based on three principles: Dignity for People, Diversity, and Sustainability.

Social Principles of Human-Centric AI: In 2019, the Japanese government published the Social Principles of Human-Centric AI as principles for implementing AI in society. The Social Principles set forth three basic philosophies: human dignity, diversity and inclusion, and sustainability. "Japan's Approach to AI Regulation and Its Impact on the 2023 G7 Presidency".[161]

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[158] Sharon Goldman, "As Israel goes to war, global AI industry faces impacts on several fronts", VentureBeat, October 16, 2023.

[159] European Commission, "Italy AI Strategy Report".

[160] Government of Japan, "AI Strategy 2022 (Overview)"

[161] Hiroki Habuka, "Japan's Approach to AI Regulation and Its Impact on the 2023 G7 Presidency", February 14, 2023.

Data Literacy in Schools: Data literacy is emphasized at elementary and secondary schools, where the government has funded computers and technology implementation. "How Japan Uses AI and Robotics to Solve Social Issues and Achieve Economic Growth".[162]

AI Education in Universities: The government provides more certifications and grants to Japanese universities offering AI education to ensure a growing pool of qualified developers and workers.

New Guidelines on the Use of AI in Education: In July 2023, Japan announced, "New government guidelines on the use of AI in education".[163] The guidelines focus on helping teachers and students understand the characteristics of the technology, while imposing some limits due to concerns about copyright infringement, personal information leaks, and plagiarism.

NETHERLANDS

The Netherlands has its: "STRATEGIC ACTION PLAN FOR AI"[164] outlining: "The government cooperates with the Dutch AI Coalition, in which companies, government agencies, knowledge institutions and educational institutions join forces to implement new AI actions that help specific domains and sectors."

NORWAY

The "National Strategy for Artificial Intelligence"[165] emphasizes the need for increased digital competence at all levels of education and for those already employed. The government wants Norway to take the lead in developing and using AI that respects individuals' rights and freedoms.

PORTUGAL

Portugal has a national initiative called "AI PORTUGAL 2030"[166]. It outlines that: "The main general objectives include added economic growth, scientific excellence, and human development increasing dramatically the qualifications of the labour force, particularly its technological qualifications, while promoting inclusion and awareness at all levels of education."

SINGAPORE

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[162] Harward Business Review, "How Japan Uses AI and Robotics to Solve Social Issues and Achieve Economic Growth", SPONSOR CONTENT FROM THE GOVERNMENT OF JAPAN, February 04, 2020.

[163] Suvendrini Kakuchi, "New government guidelines on the use of AI in education", University World News, 11 July 2023.

[164] Netherlands Government, "STRATEGIC ACTION PLAN FOR AI"

[165] Norwegian Ministry of Local Government and Modernisation, "National Strategy for Artificial Intelligence"

[166] Portugal INCoDe, "AI Portugal 2030, PORTUGUESE NATIONAL INITIATIVE ON DIGITAL SKILLS"

The AIED as a part of the national strategy for AI: Singapore has been implementing AIED as part of its national AI strategy, "Tech and education: How automation and AI are powering learning in Singapore"[167]

Automated English marking systems: The Ministry of Education is working on rolling out automated marking systems for primary and secondary English language assignments such as open-ended, short-answer questions, and essays. These AI-powered systems will catch language errors such as in grammar, spelling, and syntax. The teacher will focus on higher-level concepts such as marking for ideas, structure, content, creative expression, persuasiveness, and tone.

Adaptive learning systems for mathematics: MOE has been trialing an adaptive learning system enhanced by machine learning that can assess student performance in real time and adjust their learning pathways accordingly.

AI-enabled learning companion: Another project from the Smart Nation initiative is the development of an AI-enabled learning companion. It will be able to support holistic learning by motivating the student while he or she is doing a challenging task, encourage reflection on the learning experience, and recommend further learning activities.

Masterplan 2030: In addition to these initiatives, Singapore's Ministry of Education has launched an "Transforming Education through Technology" Masterplan 2030"[168], that guides the development of the technological ecosystem and key platforms for learning in primary schools to pre-university institutions. The masterplan maintains a broad overall 10-year vision from 2020 to 2030.

SWEDEN

"AI Competence for Sweden" is a national initiative for education and competence development in artificial intelligence. Within the initiative, thirteen universities work together to create a knowledge platform and offer courses for practicing professionals. There's a focus on AI literacy to close the gap between research and practical knowledge transfer of AI-related skills. Teachers' AI-related technological, pedagogical, and content knowledge (TPACK) are important factors for AI literacy.

The study titled "Artificial Intelligence in K-12 Education: eliciting and reflecting on Swedish teachers' understanding of AI and its implications for teaching & learning."[169] explores teachers' and teacher educators' understanding and preconceptions of AI to inform teacher education and professional development. The qualitative content analysis underpinned by the theoretical framework "Intelligent TPACK"[170] reveals that teachers' AI-related content knowledge is generally gained through incidental learning and often results in pre-and misconceptions of AI.

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[167] Gov Tech Singapore, "Tech and education: How automation and AI are powering learning in Singapore", 23 FEB 2023.

[168] Singapore, Ministry of Education, "Transforming Education through Technology" Masterplan 2030".

[169] Velander, J., Taiye, M.A., Otero, N. et al. "Artificial Intelligence in K-12 Education: eliciting and reflecting on Swedish teachers' understanding of AI and its implications for teaching & learning." Educ Inf Technol (2023).

Students in Sweden are positive towards AI tools such as ChatGPT in education, but 62% believe that using chatbots during exams is cheating. However, where the boundary for cheating lies is highly unclear. This is shown in a survey from Chalmers University of Technology, which is the first large-scale study in Europe to investigate students' attitudes towards artificial intelligence in higher education. "Students positive toward AI, but uncertain about what counts as cheating, finds survey"[171]

SWITZERLAND

Switzerland is recognized as a leader in digital transformation in education. The country's education model is one of the highest-ranked systems in the world, with a strong focus on preparing students for a world where technology is widely used. This includes training during their education to thrive in areas such as AI. "Digital transformation in education: Switzerland is a leader"[172]

TAIWAN

The Government of Taiwan has launched the "AI Taiwan Action Plan (2018-2021)" that outlines the following major components[173]:

Developing AI talent: Smart-tech researchers for senior-level positions are being trained by universities and research institutes, while more than 10,000 AI technicians and applications specialists are produced each year.

Promoting Taiwan's lead role in AI: Chips, which form the heart of AI computing, are not only a core technology but an industrial strength for Taiwan. The government is therefore working aggressively to expand the nation's world-leading position in the semiconductor chip industry.

Building Taiwan into an AI innovation hub: As international AI innovation clusters are formed in Taiwan, Microsoft, Google and other big names have set up AI R&D bases on the island, building connections with the local AI industry and creating an industrial ecosystem together for Taiwan.

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[170] Intelligent TPACK stands for "Intelligent Technological Pedagogical Content Knowledge." It is a concept in education that refers to a teacher's ability to effectively integrate technology, pedagogy (teaching methods), and content knowledge to enhance and improve the educational experience for students. Intelligent TPACK involves a deep understanding of how to use technology in a meaningful and purposeful way to support and enhance the teaching and learning process, considering the specific content being taught and the most effective pedagogical strategies. It emphasizes the importance of thoughtful and intelligent integration of technology into the educational context.

[171] Chalmers University of Technology, "Students positive toward AI, but uncertain about what counts as cheating, finds survey", PHYS ORG, MAY 11, 2023.

[172] Benjamin Robert, "Digital transformation in education: Switzerland is a leader", EHL Insights.

[173] Taiwan Department of Information Services, "AI Taiwan Action Plan (2018-2021)", Executive Yuan, 2019-08-07.

Liberalizing laws and opening test grounds: To ease restrictions on innovative technologies, Taiwan announced the Unmanned Vehicles Technology Innovative Experimentation Act, the first of its kind in the world covering autonomous vehicles on land, at sea, and in the air. Taiwan CAR Lab (Connected, Autonomous, Road-test Lab), the nation's first closed field for testing self-driving cars, has also been opened for use.

Transforming industry with AI: Guided by the demands of industrial innovation, AI talent will be matched to industrial needs to develop AI solutions and accelerate industrial innovation and digital transformation.

UNITED KINGDOM

Policy Paper: The Department for Education (DfE) published a policy paper on the use of generative artificial intelligence (AI) in the education sector, "Generative artificial intelligence in education"[174]. This document sets out the position of the DfE on the use of generative artificial intelligence (AI), including large language models (LLMs) like ChatGPT or Google Bard, in the education sector.

UK Education Secretary, in it's press release of 14 June 2023: "New drive to better understand the role of AI in education"[175] announces the launch of the following initiatives:

Call for Evidence: The UK government launched a call for evidence to better understand the role of AIED. This call for evidence also asks for views on risks, ethical considerations, and training for education workers. The call to evidence marks an important starting point, with the results providing a base to inform future work.

Digital Functional Skills Qualifications (DFSQs): The Education Secretary confirmed that courses for the new Digital Functional Skills Qualifications (DFSQs) will begin in September.

Digital and Computing Skills Education Taskforce: The UK government also launched a new Digital and Computing Skills Education Taskforce.These initiatives demonstrate the UK's commitment to harnessing AI technologies for enhancing their education system.

USA

The most significant report to date about AI is the Stanford "The AI Index 2021 Annual Report"[176]. The Report is an initiative at the Stanford Institute for Human-Centered Artificial Intelligence (HAI) that measures trends in Artificial Intelligence. The report outlines that the most of these strategies articulate plans and expectations regarding how AI will impact policy sectors, including education, and typically discuss the social and ethical implications of AI.

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[174] UK Department for Education, "Generative artificial intelligence in education", Policy Paper, 29 March 2023.

[175] UK Education Secretary, "New drive to better understand the role of AI in education", Press release,14 June 2023.

[176] Daniel Zhang, Saurabh Mishra, Erik Brynjolfsson, John Etchemendy, Deep Ganguli, Barbara Grosz, Terah Lyons, James Manyika, Juan Carlos Niebles, Michael Sellitto, Yoav Shoham, Jack Clark, and Raymond Perrault, "The AI

The annual report tracks, collates, distills, and visualizes data relating to artificial intelligence. It aims to enable decision-makers to take meaningful action to advance AI responsibly and ethically with humans in mind. The AI Index collaborates with many different organizations to track progress in artificial intelligence.

The 2023 report included new analysis on foundation models, including their geopolitics and training costs, the environmental impact of AI systems, K-12 AI education, and public opinion trends in AI. The AI Index also broadened its tracking of global AI legislation from 25 countries in 2022 to 127 in 2023.

The report is intended to provide unbiased, rigorously vetted, and globally sourced data for policymakers, researchers, executives, journalists, and the general public to develop intuitions about the complex field of AI.

This latest edition significantly expands the amount of data available in the report, which was drawn from a broader set of academic, private, and non-profit organizations for calibration. The report also shows the effect of COVID-19 on AI development from multiple perspectives, including how AI helps with COVID-related drug discovery and the effect of the pandemic on hiring and private investment. The report's mission is to provide unbiased, rigorous, and comprehensive data for policymakers, researchers, journalists, executives, and the general public to develop a deeper understanding of the complex field of AI.

The United States, the Department of Education's Office of Educational Technology is working to develop policies and supports focused on the effective, safe, and fair use of AI-enabled educational technology. On May 2023, the Office of Educational Technology has published a policy report titled "Artificial Intelligence and the Future of Teaching and Learning: Insights and Recommendations"[177] which addresses the need for sharing knowledge, engaging educators, and refining technology plans and policies for AI use in education. The report describes AI as a rapidly-advancing set of technologies for recognizing patterns in data and automating actions, and guides educators in understanding what these emerging technologies can do to advance educational goals while evaluating and limiting key risks.

The report provides insights and recommendations on how AI can be used to improve education, recognizes challenges that will arise, and develops recommendations to guide further policy development. It discusses opportunities for using AI to increase support available to students with disabilities, multilingual learners, and others who could benefit from greater adaptivity and personalization in digital tools for learning. The report also explores how AI can enable writing or improving lessons, as well as the process for finding, choosing, and adapting material for use in lessons.

Index 2021 Annual Report", AI Index Steering Committee, Human-Centered AI Institute, Stanford University, Stanford, CA, March 2021.

[177] U.S. Department of Education, "Artificial Intelligence and the Future of Teaching and Learning: Insights and Recommendations", May 2023.

7.3 WORD OF THE AUTHOR

Two years after humans first set foot on the Moon in 1968, an event of great significance in human history, the Faculty of Electrical Engineering in Zagreb installed its first IBM1130 computer. It was during this time, when I was a student there, that the subject of "Electronic Computers" was introduced. This marked our first exposure to concepts like coding, algorithms, and their application in solving various problems, primarily of a mathematical nature. It was a remarkable experience: creating an algorithm and witnessing the computer provide the desired result!

Aside from the professor's book, which mainly contained concise definitions of fundamental algorithm development concepts, we, the students, had limited access to literature. Learning this subject demanded extensive effort, dedication, and perseverance, but it was the dawn of a technological transformation that would reshape the world.

A year later, my two younger colleagues, Bashkim Abdullahu and Mato Dretvić, and I worked on a student manual that included 50 algorithm examples. We proposed this manual for publication to our professor, but he declined, explaining that his assistants were already working on a similar project. However, this setback didn't discourage us. In fact, we went on to publish our own manual, which quickly sold nearly 500 copies at an affordable price. Our manual became a bestseller, surpassing the official textbook in popularity, despite the latter's high academic standard. Our manual was deemed more suitable and practical for mastering the subject. Subsequently, we distributed this manual for free at the University of Kosova in Pristina, where the same computer setup as in Zagreb was available.

Many years after our studies concluded, we discovered that our manual had been illegally reprinted in Zagreb and sold. Strangely, this discovery did not dishearten us. Instead, it filled us with joy and pride because it indicated that our manual held substantial value for the new generation of our colleagues.

After completing my studies, I chose a combined career as a university lecturer and engineer. I worked on various projects that connected electronics with coding and then, I conveyed these experiences to my students with passion and love. Meanwhile, with great dedication, for about 4 years, I worked on my doctorate in the field of encryption of digital signals, but my paper was rejected by the magazine "Information Theory" for the simple reason that it was a "discovery", which I made and for to me it was spectacular, it had already been discovered and presented at a scientific symposium in the USA... Sciences and information technology were advancing at such a fast pace that for us in Kosova, since we still had no Internet in the 80s, it was impossible to conveyance. After that I decided to close this chapter of my academic career and returned to my engineering projects, so I gave up my scientific ambitions and dedicated myself to applications and innovation.

Today, over half a century later, we find ourselves in the digital age, where artificial intelligence (AI) has just begun to unlock unprecedented and unimaginable possibilities that will fundamentally transform all aspects of human activity. Similar transformations have occurred in the past with the advent of new technologies. However, what sets this era apart is the fact that nearly every individual on this planet can wield such a potent technological tool: a simple phone connected to the Internet.

This innovation surpasses even the fantastical imaginings of the storytellers from the tales of 1001 nights, who bestowed Aladdin with a magical lamp to combat evil and free a giant slave. Today, anyone holds the equivalent of this "lamp" in their hands: a telephone. In reality, this "lamp" is an invisible digital robot, devoid of the destructive force of Aladdin's giant but possessing the collective knowledge of all human generations. We can all agree that knowledge is humanity's most formidable weapon.

For me and my generation, who only half a century ago had the opportunity to work with the first computers, which were a technological marvel of the time, the technological revolution of artificial intelligence that has just completed, is a real shock. It is therefore understandable that many people are surprised and skeptical about AIED and this is especially true for people involved in education.

The AI "brain" is designed to respond and communicate like a human. This "brain" has a certain knowledge of its own, knows all sciences, history and arts at a very high level, knows how to search for information from the Internet, possesses the ability of logical reasoning, knows and communicates in almost all world languages, including Albanian and what is very important, it learns and improves constantly, it even performs arts and creates artworks.

The artificial intelligence system is designed on the basis of multidimensional studies of the human brain and as such is an example of it. So, we are dealing with a synthetic brain that relies on the amazing power of the world's most powerful computers and the colossal wealth of information on the Internet.

However, the possibilities of misuse of this technology are also very large and dangerous. AI, especially when used for the purposes of material gain by companies that design and deploy their own AI-powered applications and platforms, poses a great risk to education. Therefore, they must be controlled and forced to comply with strict rules of ethics, to fight intentional disinformation, hate speech, the spread of various destructive ideologies and others. This is a real battle that is happening today and is expected to happen tomorrow, especially when it comes to the use of AI, which is a very powerful and still understudied technology.

This is just the beginning and there is no turning back. The power of AI and its range of applications are growing and developing at breakneck speed. We Albanians, as a nation with a strong national identity, must take very seriously the advancement of our education by using AI for the noblest vision and goals of educating the younger generations. Therefore, in the first sentence of the vision statement for the implementation of AI in our education we must say, firmly and unequivocally that AI in education will be used as a powerful technology and tool in the hands of our educators in their mission sacred of the education of their students.

In the end, I want to demonstrate that I completed this work with the assistance of ChatGPT from OpenAI and Microsoft Bing, along with, of course, Google Translate. This experience was truly incredible. Starting from the stage of outlining the paper, I was astonished. I had a kind of structure for the paper in my mind, but I still asked the OpenAI bot for a suggested structure. I was amazed by the elegant, precise, and correct response it provided. It was a simply perfect answer! So, I continued to consistently consult these platforms for explanations, sources of information, and to verify the accuracy of the information. Before I knew it, the paper before you was complete.

I am convinced that AI will revolutionize the way we research and write, significantly enhancing productivity, efficiency, accuracy, and the quality of our work. After this experience, I'm not even certain if I can claim to be the sole author of this paper. However, I am certain that I guided its creation, defining the essence of the message I wanted to convey to the readers. Thus, I encourage you to embark on this fantastic journey into the world of writing in the age of AI.

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